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# Update: Routine Screening for Antibodies to Human Immunodeficiency Virus, Civilian Applicants for U.S. Military Service and U.S. Armed Forces, Active and Reserve Components, January 2011–June 2016

This report contains an update through June 2016 of the results of routine screening for antibodies to the human immunodeficiency virus (HIV) among civilian applicants for military service and among members of the active and reserve components of the U.S. Armed Forces. During the surveillance period, annual seroprevalences among civilian applicants for military service peaked in 2015 (0.31 per 1,000 tested), up 29% from 2014 (0.24 per 1,000 tested). Seroprevalences among Marine Corps reservists, Navy active component service members, and Navy reservists also peaked in 2015. In the Army National Guard and the reserve component of the Marine Corps, full-year seroprevalences have trended upward since 2011. Overall (January 2011–June 2016) seroprevalences were highest for Army reservists, Army National Guard members, Navy active component members, and Navy reservists. Among active and reserve component service members, seroprevalences continue to be higher among Army and Navy members and males than their respective counterparts.

Since acquired immune deficiency syndrome (AIDS) was first recognized as a distinct clinical entity in 1981,[1] its spread has had major impacts on the health of populations and on healthcare systems worldwide. The human immunodeficiency virus type 1 (HIV-1) was identified as the cause of AIDS in 1983. Since October 1985, the U.S. military has conducted routine screening for antibodies to HIV-1 to enable adequate and timely medical evaluations, treatment, and counseling; to prevent unwitting transmission; and to protect the battlefield blood supply.[2]

As part of the U.S. military's HIV screening program, civilian applicants for military service are screened for antibodies to HIV during pre-accession medical examinations. Infection with HIV is medically disqualifying for entry into U.S. military service. All members of the active and reserve components of the U.S. Armed Forces have been periodically screened since 1986 to detect newly acquired HIV infections. In 2004, the Department of Defense set a standard testing interval of 2 years for all service members. Service members who are infected with HIV receive clinical assessments, treatments, and counseling; they may remain in service as long as they are capable of performing their military duties.[2]

Before 2009, all of the aforementioned screening programs used laboratory techniques that detected only HIV-1-type infections. Starting in 2009, all programs adopted methods that allowed the detection of antibodies to both major HIV types (i.e., HIV-1 and HIV-2). Although HIV-2 infection is rare in the U.S. itself, and no instances of HIV-2 infection have thus far been detected in civilian applicants or service members since 2009, HIV-2 virus is much more prevalent in other parts of the world where service members may be required to serve. To provide for the change in laboratory methods in the past and for the prospect of future detections of HIV-2 infection in the Services' screening programs, this report will hereafter refer to the target of the screening programs as simply "HIV" without specifying either of the types.

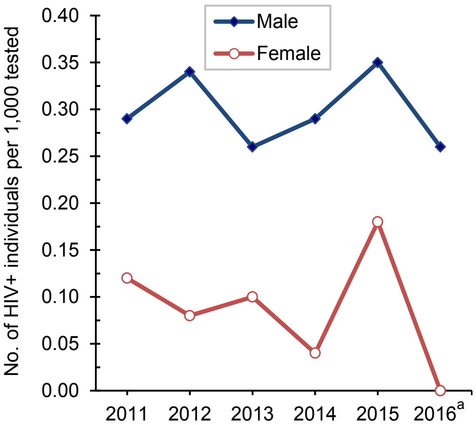
This report summarizes numbers, prevalences, and trends of newly identified HIV antibody positivity among civilian applicants for military service and members of the active and reserve components of the U.S. Armed Forces from 1 January 2011 through 30 June 2016. Summaries of results of routine screening for antibodies to HIV among civilian applicants and active and reserve component members of the U.S. military since 1990 are available at http://www.health.mil/Military-Health-Topics/Health-Readiness/Armed-Forces-Health-Surveillance-Branch/Reports-and-Publications/Medical-Surveillance-Monthly-Report.

## METHODS

The surveillance period was 1 January 2011 through 30 June 2016. The surveillance population included all civilian applicants for U.S. military service and all individuals who were screened for antibodies to HIV while serving in the active or reserve component of the Army, Navy, Air Force, or Marine Corps, during the surveillance period.

All individuals who were tested and all first-time detections of antibodies to HIV through U.S. military medical testing programs were ascertained by matching specimen numbers and serologic test results to the personal identifiers of providers of the specimens. With the exception of U.S. Air Force members, all results were accessed from records routinely maintained in the Defense Medical Surveillance System (DMSS). The U.S. Air Force provided summarized results of serologic screening for antibodies to HIV among its members.

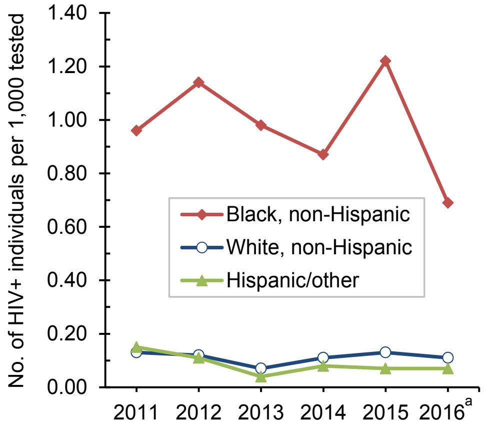
**FIGURE 1.** Diagnoses of HIV infection by sex, civilian applicants for U.S. military service, January 2011–June 2016




[a]Through 30 June 2016

An incident case of HIV antibody seropositivity was defined as two positive results from serologic testing of two different specimens from the same individual, or one positive result from serologic testing of the most recent specimen provided by an individual.

**FIGURE 2.** Diagnoses of HIV infections by race/ethnicity, civilian applicants for U.S. military service, January 2011–June 2016




[a]Through 30 June 2016

Annual prevalences of HIV seropositivity among civilian applicants for service were calculated by dividing the number of applicants identified as HIV antibody seropositive during each calendar year by the number of applicants tested during the corresponding year. For annual summaries of routine screening among U.S. service members, denominators were the numbers of individuals in each component of each service branch who were tested at least once during the relevant calendar year.

## RESULTS

### Civilian applicants

From January 2015 through June 2016, a total of 463,132 civilian applicants for U.S. military service were tested for antibodies to HIV, and 124 applicants were identified as HIV antibody positive (seroprevalence: 0.27 per 1,000 applicants tested) **(Table 1)**. During the surveillance period, annual seroprevalences among applicants for service peaked in 2015 (0.31 per 1,000 tested), up 29% from 2014 (0.24 per 1,000 tested).

Throughout the period, seroprevalences were much higher among males than

**TABLE 1.** Diagnoses of HIV infections by sex, civilian applicants for U.S. military service, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total HIV(+) | HIV(+) male | HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested |
|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | **268,038** | **260,530** | 211,199 | 49,331 | **68** | 62 | 6 | **0.26** | 0.29 | 0.12 |
| **2012** | **269,240** | **261,830** | 211,117 | 50,713 | **75** | 71 | 4 | **0.29** | 0.34 | 0.08 |
| **2013** | **276,932** | **268,657** | 216,115 | 52,542 | **62** | 57 | 5 | **0.23** | 0.26 | 0.10 |
| **2014** | **242,232** | **236,504** | 188,415 | 48,089 | **57** | 55 | 2 | **0.24** | 0.29 | 0.04 |
| **2015** | **271,184** | **264,246** | 209,902 | 54,344 | **83** | 73 | 10 | **0.31** | 0.35 | 0.18 |
| **2016[a]** | **201,772** | **198,886** | 158,467 | 40,419 | **41** | 41 | 0 | **0.21** | 0.26 | 0.00 |
| **Total** | **1,529,398** | **1,490,653** | 1,195,215 | 295,438 | **386** | 359 | 27 | **0.26** | 0.30 | 0.09 |

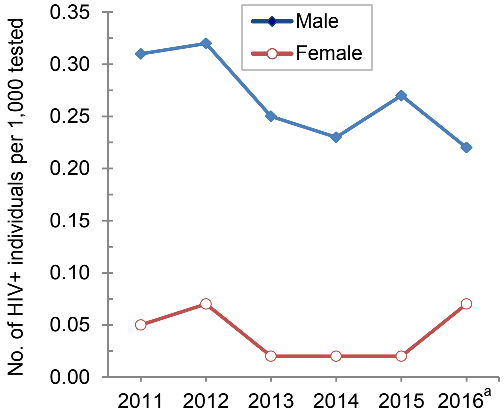
[a]Through 30 June 2016

**TABLE 2.** Diagnoses of HIV infections by race/ethnicity, civilian applicants for U.S. military service, January 2011–June 2016

| Year | Total persons tested | White, non-Hispanic tested | Black, non-Hispanic tested | Hispanic/other tested | Total HIV(+) | White, non-Hispanic HIV(+) | Black, non-Hispanic HIV(+) | Hispanic/others HIV(+) | Overall rate per 1,000 tested | White, non-Hispanic rate per 1,000 tested | Black, non-Hispanic rate per 1,000 tested | Hispanic/others rate per 1,000 tested |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | **260,534** | **173,386** | 40,551 | 46,597 | **68** | 22 | 39 | 7 | **0.26** | 0.13 | 0.96 | 0.15 |
| **2012** | **261,831** | **165,602** | 42,991 | 53,238 | **75** | 20 | 49 | 6 | **0.29** | 0.12 | 1.14 | 0.11 |
| **2013** | **268,657** | **162,922** | 48,966 | 56,769 | **62** | 12 | 48 | 2 | **0.23** | 0.07 | 0.98 | 0.04 |
| **2014** | **236,504** | **142,412** | 43,451 | 50,641 | **57** | 15 | 38 | 4 | **0.24** | 0.11 | 0.87 | 0.08 |
| **2015** | **264,246** | **158,846** | 47,641 | 57,759 | **83** | 21 | 58 | 4 | **0.31** | 0.13 | 1.22 | 0.07 |
| **2016[a]** | **198,886** | **122,938** | 34,942 | 41,006 | **41** | 14 | 24 | 3 | **0.21** | 0.11 | 0.69 | 0.07 |
| **Total** | **1,490,658** | **926,106** | 258,542 | 306,010 | **386** | 104 | 256 | 26 | **0.26** | 0.11 | 0.99 | 0.21 |

[a]Through 30 June 2016

**FIGURE 3.** New diagnoses of HIV infections by sex, active component, U.S. Army, January 2011–June 2016




[a]Through 30 June 2016

females and among black, non-Hispanics than other race/ethnicity groups **(Tables 1 and 2; Figures 1 and 2)**. Of note, during 2015–2016, seroprevalences decreased by approximately 26% among male applicants, dropped to zero among female applicants, and decreased by 43% among black, non-Hispanic applicants. During 2015, on average, one civilian applicant for service was detected with antibodies to HIV per 3,267 screening tests **(Table 1).**

## U.S. Army

*Active component:* From January 2015 through June 2016, a total of 548,974 soldiers in the active component of the U.S. Army were tested for antibodies to HIV, and 120 soldiers were identified as HIV antibody positive (seroprevalence: 0.22 per 1,000 soldiers tested) **(Table 3).**

Annual seroprevalences increased 7% from 2011 (0.27 per 1,000 tested) to 2012 (0.29 per 1,000 tested), decreased to 0.20 per 1,000 tested in 2014 and then increased 15% to 0.23 per 1,000 tested in 2015 **(Table 3)**. Annual seroprevalences for male active component Army members greatly exceed those of females **(Figure 3).**

During 2015, on average, one new HIV infection was detected among active component Army soldiers per 5,265 screening tests **(Table 3)**. Of the 515 active component

**TABLE 3.** New diagnoses of HIV infections by sex, active component, U.S. Army, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 538,932 | 431,335 | 371,983 | 59,352 | 118 | 115 | 3 | 0.27 | 0.31 | 0.05 | 41 |
| **2012** | 519,041 | 416,715 | 359,459 | 57,256 | 119 | 115 | 4 | 0.29 | 0.32 | 0.07 | 54 |
| **2013** | 506,885 | 405,158 | 348,870 | 56,288 | 87 | 86 | 1 | 0.21 | 0.25 | 0.02 | 40 |
| **2014** | 447,711 | 361,928 | 309,969 | 51,959 | 71 | 70 | 1 | 0.20 | 0.23 | 0.02 | 47 |
| **2015** | 426,462 | 349,811 | 298,206 | 51,605 | 81 | 80 | 1 | 0.23 | 0.27 | 0.02 | 70 |
| **2016[a]** | 217,608 | 199,163 | 168,805 | 30,358 | 39 | 37 | 2 | 0.20 | 0.22 | 0.07 | 39 |
| **Total** | 2,656,639 | 2,164,110 | 1,857,292 | 306,818 | 515 | 503 | 12 | 0.24 | 0.27 | 0.04 | 291 |

[a]Through 30 June 2016

**TABLE 4.** New diagnoses of HIV infections by sex, U.S. Army National Guard, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 224,407 | 187,245 | 160,547 | 26,698 | 45 | 43 | 2 | 0.24 | 0.27 | 0.07 | 12 |
| **2012** | 192,299 | 163,277 | 137,905 | 25,372 | 52 | 52 | 0 | 0.32 | 0.38 | 0.00 | 12 |
| **2013** | 173,612 | 147,713 | 122,217 | 25,496 | 52 | 51 | 1 | 0.35 | 0.42 | 0.04 | 21 |
| **2014** | 265,914 | 239,328 | 199,815 | 39,513 | 93 | 92 | 1 | 0.39 | 0.46 | 0.03 | 58 |
| **2015** | 205,479 | 181,715 | 151,096 | 30,619 | 68 | 66 | 2 | 0.37 | 0.44 | 0.07 | 49 |
| **2016[a]** | 128,841 | 122,255 | 101,259 | 20,996 | 52 | 51 | 1 | 0.43 | 0.50 | 0.05 | 52 |
| **Total** | 1,190,552 | 1,041,533 | 872,839 | 168,694 | 362 | 355 | 7 | 0.35 | 0.41 | 0.04 | 204 |

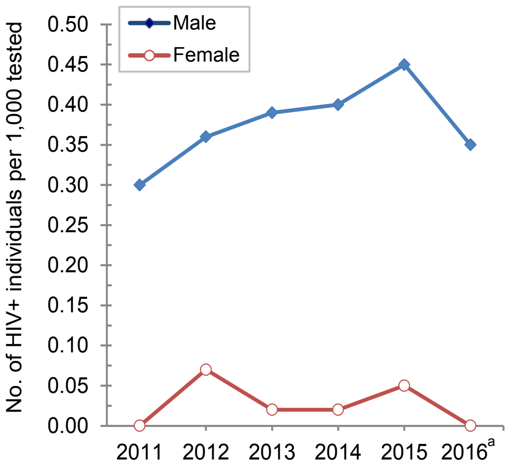
[a]Through 30 June 2016

**TABLE 5.** New diagnoses of HIV infections by sex, U.S. Army Reserve, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 106,760 | 88,714 | 68,934 | 19,780 | 37 | 35 | 2 | 0.42 | 0.51 | 0.10 | 19 |
| **2012** | 86,094 | 73,642 | 57,094 | 16,548 | 43 | 42 | 1 | 0.58 | 0.74 | 0.06 | 20 |
| **2013** | 127,338 | 113,145 | 87,324 | 25,821 | 54 | 50 | 4 | 0.48 | 0.57 | 0.15 | 33 |
| **2014** | 120,280 | 107,295 | 81,895 | 25,400 | 45 | 42 | 3 | 0.42 | 0.51 | 0.12 | 33 |
| **2015** | 121,837 | 110,104 | 84,735 | 25,369 | 42 | 42 | 0 | 0.38 | 0.50 | 0.00 | 39 |
| **2016[a]** | 62,851 | 60,104 | 45,704 | 14,400 | 27 | 27 | 0 | 0.45 | 0.59 | 0.00 | 27 |
| **Total** | 625,160 | 553,004 | 425,686 | 127,318 | 248 | 238 | 10 | 0.45 | 0.56 | 0.08 | 171 |

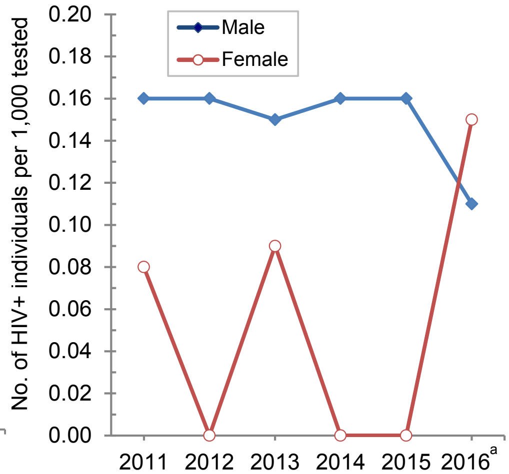
[a]Through 30 June 2016

**FIGURE 4.** New diagnoses of HIV infections by sex, active component, U.S. Navy, January 2011–June 2016



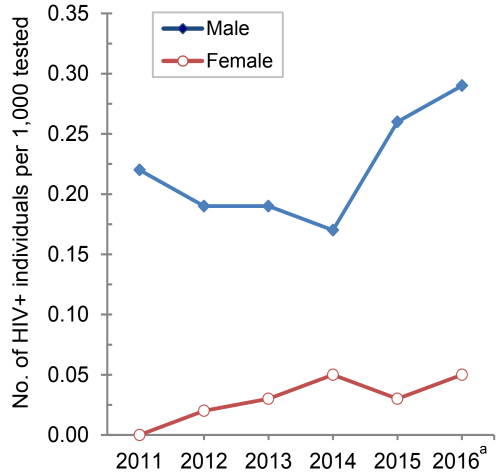

[a]Through 30 June 2016

**FIGURE 5.** New diagnoses of HIV infections by sex, active component, U.S. Marine Corps, January 2011–June 2016




[a]Through 30 June 2016

**FIGURE 6.** New diagnoses of HIV infections by sex, active component, U.S. Air Force, January 2011–June 2016




[a]Through 30 June 2016

soldiers diagnosed with HIV infections since 2011, a total of 291 (57%) were still in military service in 2016.

*Army National Guard:* From January 2015 through June 2016, a total of 303,970 members of the U.S. Army National Guard were tested for antibodies to HIV, and 120 soldiers were identified as HIV antibody positive (seroprevalence: 0.39 per 1,000 soldiers tested) **(Table 4)**. Among Army National Guard soldiers, annual seroprevalences increased each year, from 2011 through 2014 (seroprevalences: 0.24 and 0.39 per 1,000 soldiers tested, respectively), decreased somewhat in 2015 and then increased slightly in 2016.

During 2015, on average, one new HIV infection was detected among Army National Guard soldiers per 3,022 screening tests **(Table 4)**. Of the 362 National Guard soldiers who tested positive for HIV since 2011, a total of 204 (56%) were still in military service in 2016.

*Army Reserve:* From January 2015 through June 2016, a total of 170,208 members of the U.S. Army Reserve were tested for antibodies to HIV, and 69 soldiers were identified as HIV antibody positive (seroprevalence: 0.41 per 1,000 soldiers tested) **(Table 5)**.

Among Army reservists, the seroprevalence in 2012 (0.58 per 1,000 tested) was higher than in any other year of routine HIV antibody screening of Army reservists since 1991 **(data not shown)**. However, the seroprevalence among Army reservists tested from January 2015 through June 2016 was 31% lower than in 2012 **(Table 5)**.

During 2015, on average, one new HIV infection was detected among Army reservists per 2,901 screening tests **(Table 5)**. Of the 248 Army reservists diagnosed with HIV infections since 2011, a total of 171 (69%) were still in military service in 2016.

## U.S. Navy

*Active component:* From January 2015 through June 2016, a total of 341,077 active component members of the U.S. Navy were tested for antibodies to HIV, and 115 sailors were identified as HIV antibody positive (seroprevalence: 0.34 per 1,000 sailors tested) **(Table 6)**. Among tested male active component sailors, the annual HIV antibody seroprevalence increased each year between 2011 and 2015 and then declined 23% in 2016 **(Figure 4)**.

During 2015, on average, one new HIV infection was detected among active component sailors per 3,060 screening tests **(Table 6)**. Of the 388 active component sailors who tested positive for HIV since 2011, a total of 266 (69%) were still in military service in 2016.

*Navy Reserve:* From January 2015 through June 2016, a total of 55,482 members of the U.S. Navy Reserve were tested for antibodies to HIV, and 18 sailors were identified as HIV antibody positive (seroprevalence: 0.32 per 1,000 sailors tested) **(Table 7)**. The HIV antibody seroprevalence among Navy reservists in 2015 was nearly 1.5 times that in 2013 (seroprevalences: 0.46 and 0.31 per 1,000 sailors tested, respectively). The seroprevalence in 2016 (through June) was lower than in any full year of routine HIV antibody screening of Navy reservists since 1998 **(data not shown)**. Of note, only one female Navy reservist was detected with antibodies to HIV during routine screening in 2015; none were detected during 2008–2014 **(data not shown)**.

During 2015, on average, one new HIV infection was detected among Navy reservists per 2,438 screening tests **(Table 7)**. Of the 74 reserve component sailors diagnosed with HIV infections since 2011, a total of 53 (72%) were still in military service in 2016.

## U.S. Marine Corps

*Active component:* From January 2015 through June 2016, a total of 217,414 members of the active component of the U.S. Marine Corps were tested for antibodies to HIV, and 30 Marines were identified as HIV antibody positive (seroprevalence: 0.14 per 1,000 Marines tested) **(Table 8)**.

**TABLE 6.** New diagnoses of HIV infections by sex, active component, U.S. Navy, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 271,444 | 232,624 | 192,226 | 40,398 | 58 | 58 | 0 | 0.25 | 0.30 | 0.00 | 27 |
| 2012 | 273,478 | 234,250 | 192,637 | 41,613 | 72 | 69 | 3 | 0.31 | 0.36 | 0.07 | 37 |
| 2013 | 247,855 | 217,520 | 177,244 | 40,276 | 70 | 69 | 1 | 0.32 | 0.39 | 0.02 | 48 |
| 2014 | 250,384 | 222,115 | 180,799 | 41,316 | 73 | 72 | 1 | 0.33 | 0.40 | 0.02 | 51 |
| 2015 | 241,708 | 214,216 | 172,615 | 41,601 | 79 | 77 | 2 | 0.37 | 0.45 | 0.05 | 68 |
| 2016[a] | 135,133 | 126,861 | 101,938 | 24,923 | 36 | 36 | 0 | 0.28 | 0.35 | 0.00 | 35 |
| Total | 1,420,002 | 1,247,586 | 1,017,459 | 230,127 | 388 | 381 | 7 | 0.31 | 0.37 | 0.03 | 266 |

[a]Through 30 June 2016

**TABLE 7.** New diagnoses of HIV infections by sex, U.S. Navy Reserve, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 50,448 | 42,850 | 34,662 | 8,188 | 14 | 14 | 0 | 0.33 | 0.40 | 0.00 | 7 |
| 2012 | 48,212 | 41,335 | 33,312 | 8,023 | 13 | 13 | 0 | 0.31 | 0.39 | 0.00 | 8 |
| 2013 | 45,151 | 38,539 | 30,693 | 7,846 | 12 | 12 | 0 | 0.31 | 0.39 | 0.00 | 7 |
| 2014 | 42,806 | 37,609 | 29,912 | 7,697 | 17 | 17 | 0 | 0.45 | 0.57 | 0.00 | 13 |
| 2015 | 39,005 | 34,624 | 27,326 | 7,298 | 16 | 15 | 1 | 0.46 | 0.55 | 0.14 | 16 |
| 2016[a] | 22,542 | 20,858 | 16,368 | 4,490 | 2 | 2 | 0 | 0.10 | 0.12 | 0.00 | 2 |
| Total | 248,164 | 215,815 | 172,273 | 43,542 | 74 | 73 | 1 | 0.34 | 0.42 | 0.02 | 53 |

[a]Through 30 June 2016

**TABLE 8.** New diagnoses of HIV infections by sex, active component, U.S. Marine Corps, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 206,241 | 172,275 | 160,239 | 12,036 | 26 | 25 | 1 | 0.15 | 0.16 | 0.08 | 2 |
| 2012 | 202,076 | 166,046 | 154,092 | 11,954 | 25 | 25 | 0 | 0.15 | 0.16 | 0.00 | 7 |
| 2013 | 180,216 | 151,867 | 140,293 | 11,574 | 22 | 21 | 1 | 0.14 | 0.15 | 0.09 | 8 |
| 2014 | 173,344 | 146,848 | 135,130 | 11,718 | 22 | 22 | 0 | 0.15 | 0.16 | 0.00 | 11 |
| 2015 | 162,064 | 140,440 | 129,483 | 10,957 | 21 | 21 | 0 | 0.15 | 0.16 | 0.00 | 17 |
| 2016[a] | 82,950 | 76,974 | 70,380 | 6,594 | 9 | 8 | 1 | 0.12 | 0.11 | 0.15 | 9 |
| Total | 1,006,891 | 854,450 | 789,617 | 64,833 | 125 | 122 | 3 | 0.15 | 0.15 | 0.05 | 54 |

[a]Through 30 June 2016

**TABLE 9.** New diagnoses of HIV infections by sex, U.S. Marine Corps Reserve, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 32,882 | 28,027 | 26,889 | 1,138 | 4 | 4 | 0 | 0.14 | 0.15 | 0.00 | 1 |
| 2012 | 30,272 | 25,834 | 24,802 | 1,032 | 4 | 4 | 0 | 0.15 | 0.16 | 0.00 | 0 |
| 2013 | 27,651 | 24,160 | 23,174 | 986 | 4 | 4 | 0 | 0.17 | 0.17 | 0.00 | 1 |
| 2014 | 27,335 | 24,387 | 23,451 | 936 | 7 | 7 | 0 | 0.29 | 0.30 | 0.00 | 5 |
| 2015 | 26,752 | 24,018 | 23,140 | 878 | 11 | 10 | 1 | 0.46 | 0.43 | 1.14 | 6 |
| 2016[a] | 15,337 | 14,462 | 13,950 | 512 | 3 | 3 | 0 | 0.21 | 0.22 | 0.00 | 3 |
| Total | 160,229 | 140,888 | 135,406 | 5,482 | 33 | 32 | 1 | 0.23 | 0.24 | 0.18 | 16 |

[a]Through 30 June 2016

**TABLE 10.** New diagnoses of HIV infections by sex, active component, U.S. Air Force, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 283,842 | 220,635 | 178,316 | 42,319 | 39 | 39 | 0 | 0.18 | 0.22 | 0.00 | 15 |
| **2012** | 264,036 | 213,948 | 172,679 | 41,269 | 34 | 33 | 1 | 0.16 | 0.19 | 0.02 | 24 |
| **2013** | 255,649 | 208,534 | 168,662 | 39,872 | 33 | 32 | 1 | 0.16 | 0.19 | 0.03 | 22 |
| **2014** | 243,141 | 201,184 | 162,510 | 38,674 | 29 | 27 | 2 | 0.14 | 0.17 | 0.05 | 18 |
| **2015** | 231,752 | 192,811 | 155,494 | 37,317 | 42 | 41 | 1 | 0.22 | 0.26 | 0.03 | 37 |
| **2016[a]** | 122,811 | 110,508 | 89,182 | 21,326 | 27 | 26 | 1 | 0.24 | 0.29 | 0.05 | 27 |
| **Total** | 1,401,231 | 1,147,620 | 926,843 | 220,777 | 204 | 198 | 6 | 0.18 | 0.21 | 0.03 | 143 |

[a]Through 30 June 2016

**TABLE 11.** New diagnoses of HIV infections by sex, U.S. Air National Guard, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 42,484 | 53,907 | 44,380 | 9,527 | 4 | 4 | 0 | 0.07 | 0.09 | 0.00 | 3 |
| **2012** | 44,203 | 60,252 | 49,275 | 10,977 | 9 | 9 | 0 | 0.15 | 0.18 | 0.00 | 2 |
| **2013** | 39,914 | 53,941 | 43,770 | 10,171 | 4 | 4 | 0 | 0.07 | 0.09 | 0.00 | 1 |
| **2014** | 41,240 | 57,548 | 46,487 | 11,061 | 2 | 2 | 0 | 0.03 | 0.04 | 0.00 | 2 |
| **2015** | 36,563 | 53,446 | 43,073 | 10,373 | 6 | 6 | 0 | 0.11 | 0.14 | 0.00 | 6 |
| **2016[a]** | 21,900 | 35,532 | 28,732 | 6,800 | 4 | 4 | 0 | 0.11 | 0.14 | 0.00 | 4 |
| **Total** | 226,304 | 314,626 | 255,717 | 58,909 | 29 | 29 | 0 | 0.09 | 0.11 | 0.00 | 18 |

[a]Through 30 June 2016

**TABLE 12.** New diagnoses of HIV infections by sex, U.S. Air Force Reserve, January 2011–June 2016

| Year | Total HIV tests | Total persons tested | Males tested | Females tested | Total new HIV(+) | New HIV(+) male | New HIV(+) female | Overall rate per 1,000 tested | Male rate per 1,000 tested | Female rate per 1,000 tested | HIV(+) still in military service in 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 42,484 | 36,849 | 28,179 | 8,670 | 8 | 8 | 0 | 0.22 | 0.28 | 0.00 | 1 |
| **2012** | 44,203 | 38,964 | 29,264 | 9,700 | 13 | 13 | 0 | 0.33 | 0.44 | 0.00 | 4 |
| **2013** | 39,914 | 35,227 | 26,378 | 8,849 | 14 | 14 | 0 | 0.40 | 0.53 | 0.00 | 4 |
| **2014** | 41,240 | 36,715 | 27,442 | 9,273 | 8 | 8 | 0 | 0.22 | 0.29 | 0.00 | 7 |
| **2015** | 36,563 | 32,665 | 24,254 | 8,411 | 3 | 2 | 1 | 0.09 | 0.08 | 0.12 | 3 |
| **2016[a]** | 21,900 | 20,733 | 15,212 | 5,521 | 3 | 3 | 0 | 0.14 | 0.20 | 0.00 | 3 |
| **Total** | 226,304 | 201,153 | 150,729 | 50,424 | 49 | 48 | 1 | 0.24 | 0.32 | 0.02 | 22 |

[a]Through 30 June 2016

From 2011 through June 2016, prevalences of antibodies to HIV remained relatively low and stable among routinely tested Marines **(Figure 5)**.

During 2015, on average, one new HIV infection was detected among active component Marines per 7,717 screening tests **(Table 8)**. Of the 125 active component Marines diagnosed with HIV infections since 2011, a total of 54 (43%) were still in military service in 2016.

*Marine Corps Reserve:* From January 2015 through June 2016, a total of 38,480 members of the U.S. Marine Corps Reserve were tested for antibodies to HIV, and 14 Marines were identified as HIV antibody positive (seroprevalence: 0.36 per 1,000 Marines tested) **(Table 9)**. During the surveillance period, annual seroprevalences among Marine Corps reservists peaked in 2015 (0.46 per 1,000 tested) and then decreased in 2016 (0.21 per 1,000 tested). Of note, only one female Marine Corps reservist was detected with antibodies to HIV during routine screening in 2015; none were detected during 1990–2014 **(data not shown)**.

During 2015, on average, one new HIV infection was detected among Marine Corps reservists per 2,432 screening tests **(Table 9)**. Of the 33 Marine Corps reservists diagnosed with HIV infection since 2011, a total of 16 (48%) were still in military service in 2016.

## U.S. Air Force

*Active component:* From January 2015 through June 2016, a total of 303,319 active component members of the U.S. Air Force were tested for antibodies to HIV, and 69 airmen were diagnosed with HIV infections (seroprevalence: 0.23 per 1,000 airmen tested) **(Table 10)**. From 2011 through 2014, annual seroprevalences remained relatively low and stable among active component Air Force members **(Table 10)**. However, HIV antibody seroprevalence rose among tested male airmen after 2014. During 2015, on average, one new HIV infection was detected among active Air Force members per 5,518 screening tests **(Table 10)**.

*Air National Guard:* From January 2015 through June 2016, a total of 88,978 members of the Air National Guard were tested for antibodies to HIV, and 10 airmen were diagnosed with HIV infections (seroprevalence: 0.11 per 1,000 airmen tested) **(Table 11)**. Since 2010, no female Air National Guard member has been detected with antibodies to HIV during routine testing. During 2015, on average, one new HIV infection was detected among Air National Guard members per 6,094 screening tests **(Table 11)**.

*Air Force Reserve:* From January 2015 through June 2016, a total of 53,398 members of the Air Force Reserve were tested for antibodies to HIV, and six airmen were diagnosed with HIV infections (seroprevalence: 0.11 per 1,000 airmen tested) **(Table 12)**. During 2015, on average, one new HIV infection was detected among Air Force reservists per 12,188 screening tests **(Table 12)**.

*Data summaries for the U.S. Air Force were provided by the U.S. Air Force School of Aerospace Medicine (USAFSAM).*

## EDITORIAL COMMENT

For nearly 30 years, the U.S. military has conducted routine screening for antibodies to HIV among all civilian applicants for service and all active and reserve component members of the services.[2] For 20 years, results of U.S. military HIV antibody testing programs have been summarized in the *MSMR*.[3]

This report documents that, since 2011, prevalences of HIV seropositivity among civilian applicants for military service have fluctuated between 0.23 and 0.31 per 1,000 applicants tested. It is important to note that, because applicants for military service are not randomly selected from the general population of U.S. young adults, seroprevalences among applicants are not directly indicative of HIV prevalences, infection rates, or trends in the general U.S. population. As such, relatively low prevalences of HIV among civilian applicants for military service do not necessarily indicate low prevalences or incidence rates of HIV among young adults in the U.S. in general.

This report also documents that, in 2015 and 2016, compared to prior years, seroprevalences among most of the active and reserve components of the Services were relatively low, and that recent trends of seroprevalences have been relatively stable. Again, however, such results should be interpreted with consideration of the limitations of the surveillance data summarized herein. For example, because all military members have been screened as civilian applicants for service (since October 1985), routinely every 2 years (since 2004), and before and after overseas deployments (for more than a decade), routine screening now detects relatively recently acquired HIV infections (i.e., infections acquired since the most recent negative test of each affected individual). As such, annual HIV antibody seroprevalences during routine screening of military populations are reflective of, but are not direct unbiased estimates of, incidence rates and trends of acquisitions of HIV infections among military members.

So, for example, the Army National Guard and Marine Corps reservists were the only Service- and component-defined subgroups for which annual seroprevalences consistently increased since 2011. However, increasing seroprevalences among Army National Guard and Marine Corps reserve component members could reflect lengthening time intervals between routine tests (allowing more newly acquired infections to accumulate before they are detected through screening), changes in "selection criteria" for testing (e.g., targeting of individuals at presumed higher risk such as those with multiple/anonymous sexual contacts or diagnosed with sexually transmitted infections), and/or increasing rates of acquisitions of new infections.

In summary, the U.S. military has conducted comprehensive HIV prevention, education, counseling, and treatment programs for nearly 30 years. Since the beginning of the programs, routine screening of all civilian applicants for service and routine periodic testing of all active and reserve component members of the Services have been fundamental components of the military's HIV control and clinical management efforts. Summaries of results of screening programs such as those in this report provide insights into the current status and trends of HIV's impacts in various U.S. military populations.

## REFERENCES


1. Centers for Disease Control and Prevention. Kaposi's sarcoma and Pneumocystis pneumonia among homosexual men—New York City and California. *MMWR*. 1981;30(25):305–308.
2. Tramont EC, Burke DS. AIDS/HIV in the US military. *Vaccine*. 1993;11(5):529–533.
3. Army Medical Surveillance Activity. Supplement: HIV-1 in the Army. *MSMR*. 1995;1(3):12–15.

# Update: Diagnoses of Overweight and Obesity, Active Component, U.S. Armed Forces, 2011–2015

*Leslie L. Clark, PhD, MS; Stephen B. Taubman, PhD*

Excessive weight and body fat among currently serving active component members have a detrimental effect on operational effectiveness and increase the risk of both acute and chronic health effects related to overweight and obesity. During 2011–2015, the number and prevalence of active component members who received at least one clinical overweight diagnosis increased steadily (2011: n=71,168; 4.5%; 2015: n=113,958; 7.8%). Annual prevalences of clinical overweight increased most rapidly between 2011 and 2013, then remained relatively stable for the remainder of the surveillance period. Continued emphasis on improving "nutritional fitness" as well as physical fitness should continue as a priority of military medical and line leaders at every level.

To ensure a mission-ready force with a "military appearance," the Department of Defense (DoD) mandates that each military service implement "body composition programs," including enforcement of weight-for-height standards required for accession and advancement.[1-4] An increasing proportion of young adults in the general U.S. population do not meet current military weight-for-height standards.[5] Among first-time active component enlisted applicants, exceeding the weight/body fat limit was the most common reason for medical disqualifications from 2009–2013[6] and in the 2011 DoD Survey of Health Related Behaviors, 10% of active duty service members reported that they had to lose weight to join the military.[7]

Many active duty military members receive clinical diagnoses of overweight during routine medical examinations and other outpatient medical encounters. Service members who fail to meet height and weight standards during mandated physical fitness tests also may receive clinical diagnoses, especially if referred to or enrolled in service-specific programs designed to bring military members back into compliance with weight and/or body fat percentage standards (e.g., the Army Body Composition Program, the Navy Fitness Enhancement Program).

In 2011, the *MSMR* reported that the number and prevalence of active component service members who had received at least one clinical diagnosis for overweight or obesity more than tripled between 1998 and 2010.[8] This report updates the previous analysis and summarizes numbers and trends of clinical diagnoses indicative of overweight or obesity among active component members of the U.S. Armed Forces during the past 5 years.

## METHODS

The surveillance period was January 2011 through December 2015. The surveillance population included all individuals who served in the active component of the U.S. military at any time during the surveillance period. Members of the U.S. Coast Guard were not included in this analysis. The source of data for this analysis was the Defense Medical Surveillance System (DMSS), which includes records of all outpatient encounters of active component members in fixed U.S. military and civilian (i.e., purchased care) medical facilities if reimbursed through the Military Health System.

Events of interest for analyses were outpatient encounters with diagnoses (in any diagnostic position) specific for or suggestive of clinical overweight/obesity, subsequently referred to as "clinical overweight." Diagnoses of clinical overweight were identified during outpatient encounters using the ICD-9 and ICD-10 codes listed in **Table 1**. The codes were also classified into specific overweight and obesity categories by ICD-9 and ICD-10 codes as shown in **Table 2**.

For each year of the surveillance period, the prevalence of clinical overweight was estimated by dividing the number of service members who received at least one clinical overweight-related diagnosis during an outpatient encounter during the year by the number of individuals who served in the active component of the U.S. Armed Forces any time during the year. Each individual could be considered a new, or first time, case of clinical overweight only once during the surveillance period; service members could then be considered a previously diagnosed or repeat case during each subsequent year in which a clinical overweight diagnosis was recorded.

## RESULTS

During 2011–2015, the number and prevalence of active component members who received at least one clinical overweight diagnosis increased steadily (2011: n=71,168, 4.5%; 2015: n=113,958, 7.8%). Annual prevalences of clinical overweight

**TABLE 1.** ICD-9/ICD-10 codes used to identify diagnoses of clinical overweight

| ICD-9 | Description | ICD-10 | Description |
|---|---|---|---|
| 278.0 | Overweight and obesity | | |
| 278.00 | Obesity, unspecified | E66.9 | Obesity, unspecified |
| 278.01 | Morbid obesity | E66.01 | Morbid (severe) obesity due to excess calories |
| 278.02 | Overweight | E66.3 | Overweight |
| 278.03 | Obesity hypoventilation syndrome | E66.2 | Morbid (severe) obesity with alveolar hypoventilation |
| | | E66.09 | Other obesity due to excess calories |
| | | E66.1 | Drug-induced obesity |
| | | E66.8 | Other obesity |
| V85.21 | BMI between 25.0–25.9, adult | Z68.25 | BMI between 25.0–25.9, adult |
| V85.22 | BMI between 26.0–26.9, adult | Z68.26 | BMI between 26.0–26.9, adult |
| V85.23 | BMI between 27.0–27.9, adult | Z68.27 | BMI between 27.0–27.9, adult |
| V85.24 | BMI between 28.0–28.9, adult | Z68.28 | BMI between 28.0–28.9, adult |
| V85.25 | BMI between 29.0–29.9, adult | Z68.29 | BMI between 29.0–29.9, adult |
| V85.3x | BMI between 30.0–39.9, adult | Z68.3x | BMI between 30.0–39.9, adult |
| V85.4x | BMI 40 and over, adult | Z68.4x | BMI greater than or equal to 40.0, adult |
| If less than 20 years of age: | | | |
| V85.53 | BMI, pediatric, 85th percentile to less than 95th percentile for age | Z68.53 | BMI, pediatric, 85th percentile to less than 95th percentile for age |
| V85.54 | BMI, pediatric greater than or equal to 95th percentile for age | Z68.54 | BMI, pediatric greater than or equal to 95th percentile for age |

BMI, body mass index

**TABLE 2.** ICD–9/ICD–10 codes used for classification of diagnoses into specific overweight and obesity categories

| Diagnosis | ICD-9 codes | ICD-10 codes |
|---|---|---|
| Overweight | 278.02, V85.2x, V85.53 | E66.3, Z68.25–Z68.29 |
| Obese | 278.00, 278.03 V85.3x, V85.54 | E66.09, E66.1, E66.8, E66.9, Z68.3x |
| Morbidly obese | 278.01, V85.4x | E66.01, E66.2, Z68.4x |
| Nonspecific overweight/obesity | 278.0 | None |

increased most rapidly between 2011 and 2013 and remained relatively stable for the remainder of the surveillance period **(Table 3)**.

During 2011–2015, the largest absolute increase in annual prevalence (unadjusted) of clinical overweight was among service members aged 40 years or older (2011–2015, prevalence difference [PD]: 4.9%) **(Table 3)**.

In 2015, the highest subgroup-specific prevalences of clinical overweight were among females (10.3%), healthcare workers (9.8%), and those aged 40 years or older (12.0%). The lowest prevalences of overweight/obesity were among those in combat occupations (6.7%) and those younger than 20 years of age (3.1%) **(Table 3)**. In both male and female service members, annual prevalence of clinical overweight was highest in those aged 40 years or older. This age group also experienced the greatest increase in annual prevalence of clinical overweight over the surveillance period **(Figures 1a and 1b)**.

The numbers of first-time recipients of diagnoses (incident cases) increased over the surveillance period, although the increase was more pronounced for overweight diagnoses (2011: 23,645; 2015: 36,443) than for obesity diagnoses (2011: 17,836; 2015: 21,321). The peak number of incident diagnoses of both overweight and obesity diagnoses occurred in 2013. For incident cases of clinical overweight, a greater percentage were for diagnoses classified as overweight. **(Table 4)**. The percentage of incident diagnoses attributable to obesity diagnoses declined from 43.0% to 36.9% during the surveillance period **(Figure 2)**. In contrast, a greater percentage of repeat (recurrent) diagnoses were for obesity, rather than overweight. The relative proportion of recurrent diagnoses attributable to obesity-specific diagnoses also declined during the surveillance period **(Table 4, Figure 2)**.

## EDITORIAL COMMENT

The epidemic of obesity in the general U.S. population is well documented and highly publicized. The implications of this epidemic for the U.S. military are significant. The increase in obesity in the general population has resulted in a concomitant increase in the number of applicants for military service who are overweight and obese and at risk of being deemed "medically unfit for service." Excessive weight and body fat among currently serving active component members have a detrimental effect on operational effectiveness and increase the risk of both acute and chronic health effects (e.g., musculoskeletal injury, cardiovascular disease) related to overweight and obesity.[5]

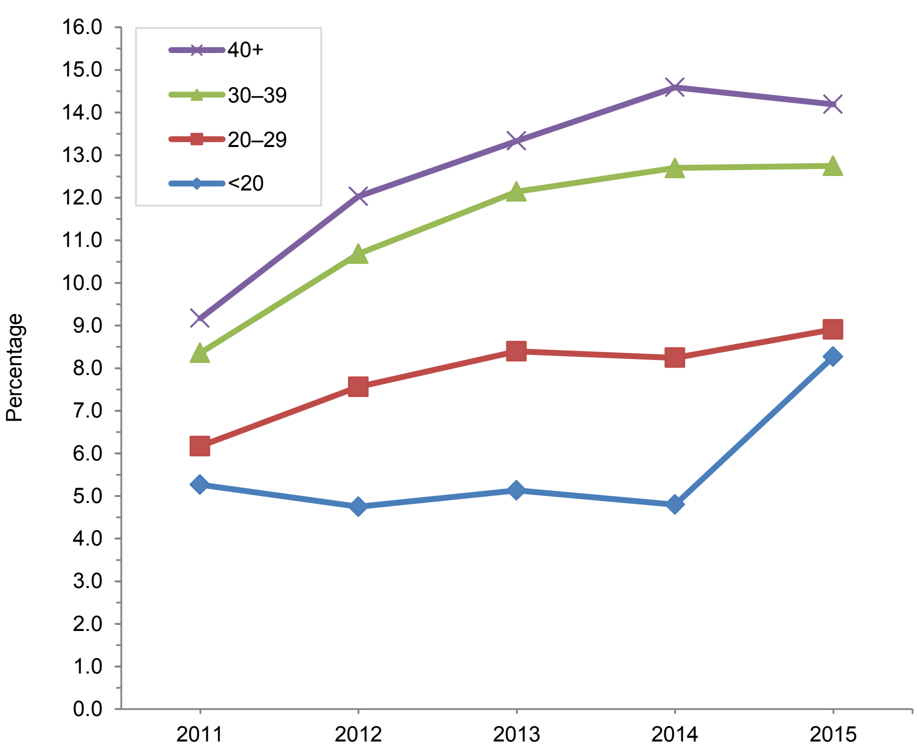
This report documents an increase in the annual prevalence of diagnoses of clinical overweight during the 5-year surveillance period. In 2015, approximately one in 10 active component females and one in 13 active component males had received at least one diagnosis indicating clinical overweight. Among military members in general, prevalences of overweight/obesity diagnoses are higher among females than males and increase with age. During the period of interest for this report, prevalences of clinical overweight increased among males and females in every age group.

A significant limitation of this report is the reliance on provider-assigned clinical diagnoses of clinical overweight rather than actual measurements of heights and weights.

**TABLE 3.** Annual numbers and percentages of service members who received an outpatient diagnosis of overweight/obesity, by calendar year, active component, U.S. Armed Forces, January 2011–December 2015

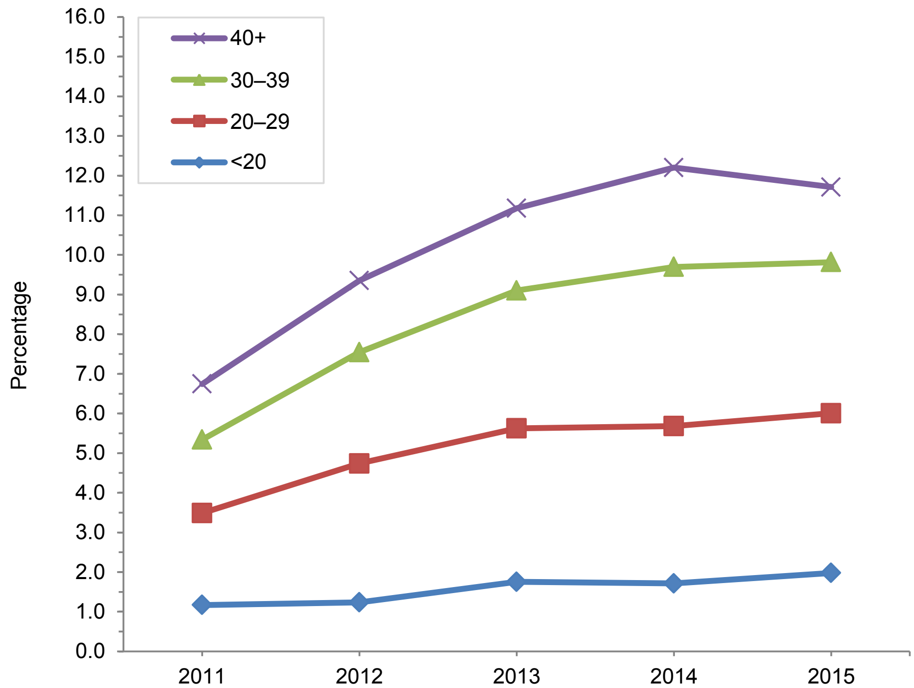
| | 2011 | | 2012 | | 2013 | | 2014 | | 2015 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 71,168 | 4.5 | 94,804 | 6.1 | 110,619 | 7.2 | 111,262 | 7.4 | 113,958 | 7.8 |
| Sex | | | | | | | | | | |
| Male | 55,348 | 4.1 | 75,330 | 5.7 | 88,878 | 6.8 | 89,525 | 7.1 | 90,625 | 7.4 |
| Female | 15,820 | 6.9 | 19,474 | 8.4 | 21,741 | 9.4 | 21,737 | 9.5 | 23,333 | 10.3 |
| Race/ethnicity | | | | | | | | | | |
| White, non-Hispanic | 40,386 | 4.1 | 53,790 | 5.6 | 61,072 | 6.6 | 60,816 | 6.8 | 61,535 | 7.2 |
| Black, non-Hispanic | 14,908 | 6.0 | 19,483 | 7.9 | 23,442 | 9.5 | 23,654 | 9.8 | 23,942 | 10.0 |
| Other | 15,874 | 4.5 | 21,531 | 6.0 | 26,105 | 7.2 | 26,792 | 7.4 | 28,481 | 7.8 |
| Age | | | | | | | | | | |
| <20 | 2,116 | 1.9 | 2,186 | 1.8 | 2,941 | 2.3 | 2,794 | 2.3 | 3,413 | 3.1 |
| 20–24 | 17,874 | 3.4 | 22,552 | 4.4 | 25,186 | 5.1 | 25,140 | 5.1 | 26,116 | 5.6 |
| 25–29 | 17,578 | 4.6 | 23,623 | 6.3 | 26,933 | 7.4 | 26,227 | 7.5 | 26,279 | 7.7 |
| 30–34 | 11,807 | 5.2 | 16,769 | 7.3 | 20,112 | 8.7 | 21,220 | 9.4 | 21,606 | 9.5 |
| 35–39 | 10,772 | 6.4 | 14,741 | 9.0 | 17,307 | 10.8 | 17,491 | 11.2 | 17,999 | 11.3 |
| 40+ | 11,021 | 7.1 | 14,933 | 9.7 | 18,140 | 11.5 | 18,390 | 12.5 | 18,545 | 12.0 |
| Military occupation | | | | | | | | | | |
| Combat | 7,741 | 3.4 | 10,744 | 4.8 | 12,568 | 5.7 | 13,374 | 6.3 | 13,764 | 6.7 |
| Health care | 8,660 | 6.6 | 11,146 | 8.3 | 13,363 | 9.9 | 13,372 | 10.0 | 12,724 | 9.8 |
| Other | 54,767 | 4.5 | 72,914 | 6.1 | 84,688 | 7.2 | 84,516 | 7.3 | 87,470 | 7.8 |

**FIGURE 1a.** Annual percentages of female service members who received a clinical diagnosis of overweight, by age group, active component, U.S. Armed Forces, 2011–2015




The latter would allow for calculation of body mass index (BMI), a frequently used metric to report on the prevalence of overweight and obesity. For adults aged 20 years and older, a BMI of 30.0 or greater is considered obese and a BMI between 25.0 and 30.0 is considered overweight. Using these criteria applied to data from the National Health and Nutrition Examination Survey (NHANES) for 2013–2014, the estimated prevalence of obesity in American males and females aged 20–39 years (the age group most closely comparable to most members of the U.S. military) was 31.6% and 37.0%, respectively.[9] In contrast, among respondents to a 2011 survey of health-related behaviors among active duty service members, 13.5% of males and 6.4% of females were classified as "obese" based on BMI calculated from self-reported height and weight indicating that military members are less likely to be obese than their civilian counterparts.[7] Additional encouraging findings of this report indicate that among individuals diagnosed with clinical overweight,

**FIGURE 1b.** Annual percentages of male service members who received a clinical diagnosis of overweight, by age group, active component, U.S. Armed Forces, 2011–2015




the proportion of obesity-specific diagnoses has steadily declined over the past 5 years. However, in the same DoD survey of health-related behaviors, 54.2% of active duty male personnel and 34.4% of female personnel were classified as being overweight and this report documents that the number of overweight-specific diagnoses increased every year of the surveillance period.

Relying on clinical diagnoses to estimate prevalence and trends of "overweight/obesity" may reflect changes in clinical practice (e.g., referrals for nutritional counseling), medical administrative procedures (e.g., diagnostic coding), and/or health-care-seeking behaviors rather than actual changes in overweight/obesity prevalence. Also, the finding of higher numbers of medical encounters for overweight/obesity may reflect increasing uses of medical care for medical/nutritional counseling by, rather than increasing numbers of, overweight/obese service members. If so, this finding may reflect increasing awareness of the adverse health effects of overweight/obesity by affected service members, more effective community health education efforts, and/or more aggressive clinical prevention programs related to obesity, exercise, and nutrition. In addition, regular physical exercise and periodic fitness testing are important parts of the training regimens of most military units and military members must maintain compliance with service-specific height-weight standards to continue service. Increased diagnoses of clinical overweight could also reflect better documentation of referrals into service-specific programs after failure to meet height and weight standards during mandated annual physical standard testing.

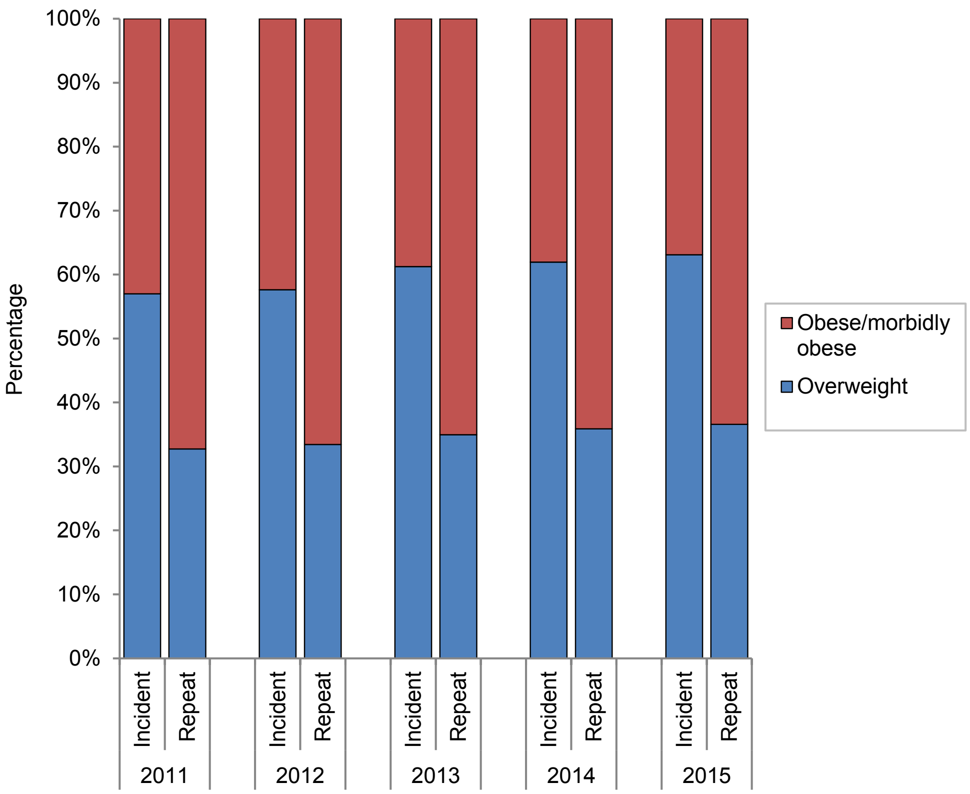
The DoD has developed a number of service-specific and DoD-wide initiatives to promote behaviors that would have a positive impact on weight and fitness. For example, the Healthy Base Initiative, a demonstration project launched in 2013, was designed to promote healthy eating, active lifestyles, and tobacco-free living. This project was part of the DoD's Operation Live Well, another DoD initiative focused on holistic health management with an emphasis on fitness, nutrition, emotional well-being, and tobacco-free living.

The results of this analysis suggest that continued emphasis on improving "nutritional fitness" as well as physical fitness should continue as a priority of military medical and line leaders at every level.

**TABLE 4.** Counts and percentages of overweight, obese, and morbidly obese in incident (first time) and repeat cases, by year, active component, U.S. Armed Forces, 2011–2015

| | 2011 | | 2012 | | 2013 | | 2014 | | 2015 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| *Incident cases* | | | | | | | | | | |
| Overweight | 23,645 | 57.0 | 30,563 | 57.6 | 36,980 | 61.2 | 35,133 | 61.9 | 36,443 | 63.1 |
| Obese, morbidly obese | 17,836 | 43.0 | 22,467 | 42.4 | 23,397 | 38.8 | 21,582 | 38.1 | 21,321 | 36.9 |
| Total | 41,481 | 100.0 | 53,030 | 100.0 | 60,377 | 100.0 | 56,715 | 100.0 | 57,764 | 100.0 |
| *Repeat cases* | | | | | | | | | | |
| Overweight | 9,716 | 32.7 | 13,964 | 33.4 | 17,560 | 35.0 | 19,578 | 35.9 | 20,557 | 36.6 |
| Obese, morbidly obese | 19,971 | 67.3 | 27,810 | 66.6 | 32,682 | 65.0 | 34,969 | 64.1 | 35,637 | 63.4 |
| Total | 29,687 | 100.0 | 41,774 | 100.0 | 50,242 | 100.0 | 54,547 | 100.0 | 56,194 | 100.0 |

**FIGURE 2.** Percentages of overweight, obese, and morbidly obese by incident and repeat cases, by year, active component, U.S. Armed Forces, 2011–2015




## REFERENCES


1. Department of the Army, Headquarters, Army Resolution 40-501. Standards of Medical Fitness. 14 December 2007.
2. U.S. Navy, Commander, Navy Recruiting Command. Exhibit 020701 Navy Recruiting Manual-Enlisted COMNAVCRUITCOMINST 1130.8J. Vol. 2. 17 May 2011.
3. Department of the Air Force. Air Force Instruction 36-2905. Fitness Program. 2 August 2013.
4. Department of the Navy. Headquarters. MCO 6110.3 Marine Corps Body Composition and Military Appearance Program. 8 August 2008.
5. Defense Health Board. Implications of Trends in Obesity and Overweight for the Department of Defense. 2013.
6. Accession Medical Standards Analysis and Research Activity (AMSARA). Annual Report 2015: Attrition and Morbidity Data for 2014 Accessions. Division of Preventive Medicine, Walter Reed Army Institute of Research. 2015;60–66.
7. Department of Defense. DoD Survey of Health Related Behaviors Among Active Duty Military Personnel. 2011;31–39.
8. Armed Forces Health Surveillance Center. Diagnoses of overweight/obesity, active component, U.S. Armed Forces, 1998–2010. *MSMR*. 2011;18(1):2–6.
9. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of child and adult obesity in the United States, 2011–2012. *JAMA*. 2014;311(8):806–814.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# Update: Osteoarthritis and Spondylosis, Active Component, U.S. Armed Forces, 2010–2015

*Valerie F. Williams, MA, MS; Leslie L. Clark, PhD, MS; Gi-Taik Oh, MS*

During the 6-year surveillance period, a total of 56,935 incident diagnoses of osteoarthritis (OA) and 60,968 incident diagnoses of spondylosis were identified. Age-specific rates of OA and spondylosis increased markedly with age and were higher among Army members and those in armor/motor transport occupations, compared to their respective counterparts. Among service members aged 25 years or older, the rate of OA overall was higher among black, non-Hispanic than other race/ethnicity group members, and the rate of shoulder OA was higher among males than females. Among service members aged 35 years or older, rates of OA of the knee and pelvic region/thigh were higher among females than males. Age-specific rates of spondylosis were generally higher among white, non-Hispanic than other race/ethnicity group members. Crude overall incidence rates of spondylosis were generally similar between sexes for all anatomical locations except the cervical region (20% higher for females than males). Findings suggest a need for additional research to identify military-specific equipment and activities that increase risk of acute and chronic damage to joints.

Osteoarthritis (OA), the most common form of arthritis, is a non-inflammatory degenerative joint disease characterized by destruction of articular cartilage and remodeling of subarticular bone that can result in significant pain, joint effusion (abnormal accumulation of fluid in or around a joint), limitations in function, and progressive disability.[1] "Spondylosis" is osteoarthritis of the spine. Risk factors for OA/spondylosis include advancing age, female sex, obesity, family history, joint hypermobility, anatomic deformities, repetitive joint loading,[2-6] and traumatic joint injury (e.g., during occupational or recreational activities).[7-9]

OA/spondylosis is a leading cause of pain and functional impairment in working age adults and the elderly[10-12]; as such, OA/spondylosis accounts for significant morbidity burdens among the U.S. general and military populations.[13-17] In a 2011 report, Cameron and colleagues estimated that, from 1999 to 2008, incidence rates of OA were significantly higher among U.S. active duty service members than comparably aged civilians.[18] Likely causes, at least in part, for the relatively high rates of OA among military members include the physical stresses associated with military training (e.g., running in formation), operations (e.g., heavy load bearing; hand-to-hand combat training), and occupations (e.g., pilots and crews of fixed- and rotary-wing aircraft; drivers and crews of military vehicles; paratroopers).[19-21]

Despite the significant morbidity and healthcare costs attributable to OA, there are relatively few published, population-based estimates of the incidence of this condition. Studies that have focused on estimating incidence rates for OA have typically generated estimates related to a single joint.[14, 22-24] Moreover, few studies have focused on the incidence of OA in younger and physically active populations. Given their potential exposure to repetitive joint loading activities and rigorous occupational tasks, active component U.S. service members are a high-risk population of epidemiologic interest in general and of military medical concern. Of note in this regard, OA is a leading cause of disability and medical discharges among U.S. military members.[15,16]

In 2010, the MSMR reported on the incidence of OA and spondylosis from 2000 through 2009.[25] The current report represents an update to this analysis and summarizes the numbers, rates, trends, and demographic and occupational characteristics of active component members of the U.S. Armed Forces who were diagnosed with either OA or spondylosis from 2010 through 2015.

## METHODS

The surveillance period was 1 January 2010 through 31 December 2015. The surveillance population included all active component service members of the U.S. Army, Navy, Air Force, and Marine Corps who served at any time during the surveillance period. Records of both inpatient and outpatient healthcare encounters documented in the databases of the Defense Medical Surveillance System (DMSS) were searched to ascertain cases of OA/spondylosis.

An incident case of OA/spondylosis was defined by a record of a hospitalization or records of two outpatient encounters within 2 years that included an ICD-9/ICD-10 code for "osteoarthritis" or "spondylosis" in any diagnostic position **(Table 1)**. Each individual could be diagnosed as an incident case of OA and an incident case of spondylosis only one time each during the surveillance period; that is, incident cases of OA could be diagnosed as spondylosis cases and vice versa. Prevalent cases (i.e., individuals with incident encounters prior to the surveillance period) were excluded from the analysis.

The fifth digit of OA ICD-9 diagnosis codes and site-specific ICD-10 codes were used to summarize the anatomical locations of related conditions **(Table 1)**; if individuals received more than one OA indicator diagnosis, specific anatomical locations (e.g., shoulder, lower leg) were prioritized over nonspecific locations (i.e., unspecified, unknown, multiple). The fourth digit of spondylosis ICD-9 diagnosis codes and site-specific ICD-10 codes were used to summarize the anatomical locations of related condition. Incidence rates for OA and spondylosis were compared across several demographic characteristics (age group, sex, race/ethnicity, branch of military service, rank and military occupation) and for each year of the surveillance period.

## RESULTS

During the 6-year surveillance period, a total of 56,935 incident diagnoses of OA and 60,968 incident diagnoses of spondylosis were identified **(Table 2)**. The crude (unadjusted) incidence rate of OA increased by 24.0% between 2010 (640 per 100,000 p-yrs) and 2012 (794 per 100,000 p-yrs) and then decreased to 647 per 100,000 p-yrs in 2015 (18.5% decrease). The rate of spondylosis increased by 48.0% between 2010 (587 per 100,000 p-yrs) and 2012 (868 per 100,000 p-yrs), remained relatively stable until 2014 and then decreased by 30.0% in 2015 (604 cases per 100,000 p-yrs) **(Figure 1)**.

### Age

For both conditions, there were marked increases in crude overall incidence rates with advancing age. For example, for OA, incidence rates were approximately four times higher among those aged 20–24 years than teenaged service members; and rates approximately doubled with every 5 years of age thereafter. For spondylosis, incidence rates were approximately five times higher among those aged 20–24 years than teenaged service members; and rates increased by 55%–110% with every 5 years of age thereafter **(Table 2)**.

### Military service

Among the Services, crude overall rates of OA were highest in the Army and lowest in the Marine Corps **(Table 2)**. However, in each 5-year age interval (older than 20 years), rates of OA were highest in the Army, intermediate, and very similar in the Air Force and Marine Corps, and lowest in the Navy **(Figure 2)**.

Crude overall incidence rates of spondylosis were highest in the Army and lowest in the Navy. Also, in each 5-year age interval (older than 20 years), rates of spondylosis were highest in the Army, intermediate in the Air Force and Marine Corps, and lowest in the Navy **(Figure 3)**.

### Sex

During 2010–2015, the crude overall incidence rate of OA was moderately higher among males than females (716 per 100,000 p-yrs and 675 per 100,000 p-yrs, respectively) **(Table 2)**. Among service members aged 39 years or younger, rates of OA were very similar among males and females of similar ages; however, among service members aged 40 years or older, the OA rate was 14.0% higher among females than males **(data not shown)**.

During the same period, the crude overall incidence rate of spondylosis was higher among females (803 per 100,000 p-yrs) than males (748 per 100,000 p-yrs) **(Table 2)**. In each age group, age-specific rates of spondylosis were slightly higher among females than males; notably, among service members aged 40 years or older, the spondylosis incidence rate was 16.3% higher among females than males **(data not shown)**.

### Race/ethnicity

The crude overall incidence rate of OA was considerably higher among black, non-Hispanic service members than other race/ethnicity groups **(Table 2)**. Among service members aged 25 years or older, the rate of OA was higher among black, non-Hispanics than other racial/ethnic groups; notably, among those aged 40 years or older, the rate was 57.3% higher among black, non-Hispanics than white, non-Hispanics. Among service members aged 20 years or older, the lowest incidence rates of OA were among Asian/Pacific Islanders; of note, among service members aged 40 years or older, the OA incidence rate was 48.3% lower among

**TABLE 1.** ICD codes used to identify osteoarthritis and spondylosis

| Condition | ICD-9 | ICD-10 |
|---|---|---|
| Osteoarthritis | | |
| Site unspecified | 715.x0 | M15.0, M19.9x |
| Shoulder region | 715.x1 | M19.x1 |
| Upper arm | 715.x2 | M19.x2 |
| Forearm | 715.x3 | M19.x3 |
| Hand | 715.x4 | M19.x4 |
| Pelvic region and thigh | 715.x5 | M16.xx |
| Lower leg (knee) | 715.x6 | M17.xx |
| Ankle and foot | 715.x7 | M19.x7 |
| Other specified sites | 715.x8 | – |
| Multiple sites | 715.x9 | M15.3, M15.8, M15.9 |
| Spondylosis | | |
| Cervical | 721.0, 721.1 | M47.812, M47.12 |
| Thoracic | 721.2, 721.41 | M47.814, M47.14 |
| Lumbar | 721.3, 721.42 | M47.817, M47.16 |
| Other | 721.5–721.8 | M48.20, M48.10, M48.30, M48.9 |
| Unspecified site | 721.9x | M47.819, M47.10 |

**TABLE 2.** Incidence counts and unadjusted incidence rates for osteoarthritis by year, active component, U.S. Armed Forces, 2010–2015

| | Total 2010–2015 | | | |
|---|---|---|---|---|
| | Osteoarthritis | | Spondylosis | |
| | No. | Rate[a] | No. | Rate[a] |
| Total | 56,935 | 710 | 60,968 | 756 |
| Service | | | | |
| Army | 30,390 | 985 | 33,261 | 1,069 |
| Navy | 8,606 | 456 | 7,534 | 397 |
| Air Force | 13,309 | 704 | 14,005 | 737 |
| Marine Corps | 4,630 | 401 | 6,168 | 534 |
| Sex | | | | |
| Male | 48,937 | 716 | 51,424 | 748 |
| Female | 7,998 | 675 | 9,544 | 803 |
| Race/ethnicity | | | | |
| White, non-Hispanic | 33,101 | 680 | 40,184 | 824 |
| Black, non-Hispanic | 13,365 | 1,053 | 9,462 | 729 |
| Hispanic | 5,613 | 550 | 6,218 | 608 |
| American Indian/Alaska Native | 503 | 589 | 514 | 598 |
| Asian/Pacific Islander | 1,829 | 594 | 1,871 | 606 |
| Other | 2,524 | 540 | 2,719 | 580 |
| Age | | | | |
| <20 | 185 | 37 | 258 | 52 |
| 20–24 | 3,726 | 143 | 6,691 | 257 |
| 25–29 | 7,071 | 355 | 10,924 | 550 |
| 30–34 | 8,930 | 704 | 11,163 | 879 |
| 35–39 | 13,395 | 1,517 | 13,272 | 1,487 |
| 40+ | 23,628 | 3,073 | 18,660 | 2,304 |
| Occupation | | | | |
| Combat-specific | 8,001 | 703 | 8,980 | 786 |
| Armor/motor transport | 2,252 | 761 | 2,691 | 905 |
| Pilot/air crew | 1,904 | 625 | 2,095 | 686 |
| Repair/engineering | 14,914 | 639 | 16,294 | 696 |
| Communications/intelligence | 14,114 | 808 | 14,713 | 836 |
| Health care | 5,965 | 857 | 6,186 | 882 |
| Other | 9,785 | 651 | 10,009 | 662 |
| Rank | | | | |
| Junior enlisted (E1–E4) | 8,527 | 238 | 13,564 | 379 |
| Senior enlisted (E5–E9) | 34,629 | 1,123 | 35,806 | 1,151 |
| Junior officer (O1–O4 [W1–W3]) | 7,948 | 716 | 7,495 | 671 |
| Senior officer (O5–O10 [W4–W5]) | 5,831 | 2,423 | 4,103 | 1,618 |

[a]Rate per 100,000 person-years

Asian/Pacific Islanders than black, non-Hispanics **(Figure 4)**.

The crude overall incidence rate of spondylosis was moderately higher among white, non-Hispanics than other race/ethnicity groups **(Table 2)**. In each age group except the oldest (40 years and older), rates of spondylosis were higher among white, non-Hispanic service members than those in any other race/ethnicity group. Of note, among service members aged 30 years or older, spondylosis rates were lower among Asian/Pacific Islanders than any other race/ethnicity group **(Figure 5)**.

### Occupation and rank

Crude overall rates of OA were higher among service members in health care (857 per 100,000 p-yrs) and communications/intelligence (808 per 100,000 p-yrs) than in other occupational groups **(Table 2)**. However, among service members aged 30 years or older, rates of OA were higher among those in armor/motor transport than any other occupational group. Of note, in all age groups aged 20 years or older, rates of OA were lower among those in pilot/air crew than any other occupational group **(Figure 6)**.

Crude overall rates of spondylosis were higher among service members in armor/motor transport (905 per 100,000 p-yrs) and health care (882 per 100,000 p-yrs) than in other occupational groups (**Table 2**). Among service members aged 30 years or older, rates of spondylosis were highest among those in armor/motor transport, while in all age groups 20 years or older, rates of spondylosis were lowest among pilots and air crews **(Figure 7)**.

For both OA and spondylosis, crude overall incidence rates were higher among senior officers and senior enlisted service members compared to their more junior, and generally younger, counterparts **(Table 2)**.

### Anatomical site

More than two-thirds of all incident diagnosed cases of OA involved the lower leg (knee joint) (311 per 100,000 p-yrs) and shoulder (176 per 100,000 p-yrs) **(data not shown)**. Crude rates of OA diagnoses of the knee were slightly higher among females than males; also, rates of OA diagnoses of the pelvic region/thigh, hand, and unspecified sites were 30%–65% higher among females than males. Rates of diagnoses of OA of the upper arm (elbow) and shoulder were 3.5 and 2.2 times higher, respectively, among males than females **(Figure 8)**.

Among service members under 25 years of age, incidence rates of OA of all

**FIGURE 1.** Unadjusted incidence rates of osteoarthritis and spondylosis, active component, U.S., Armed Forces, 2010–2015

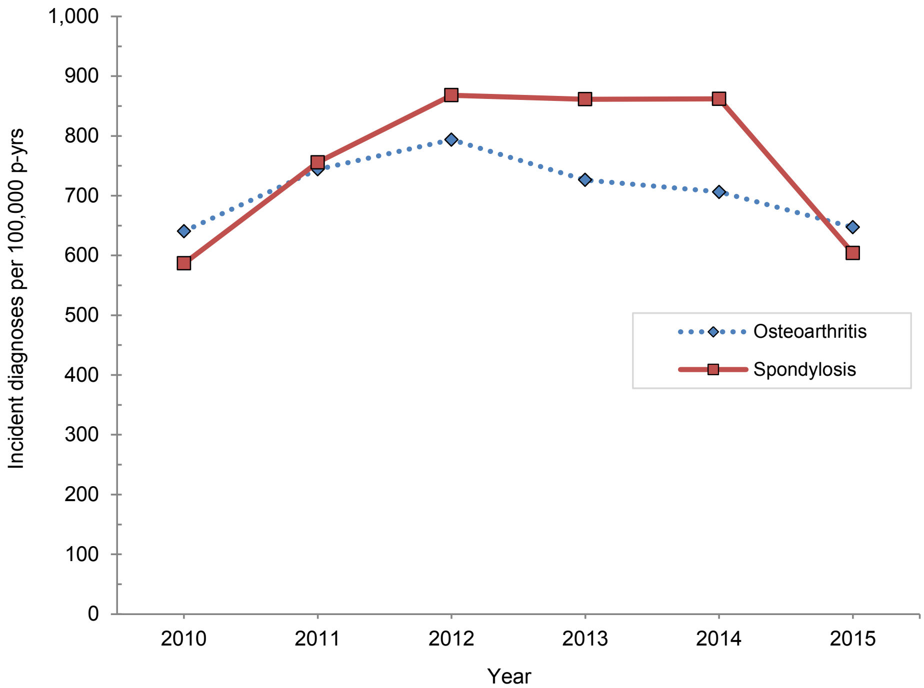
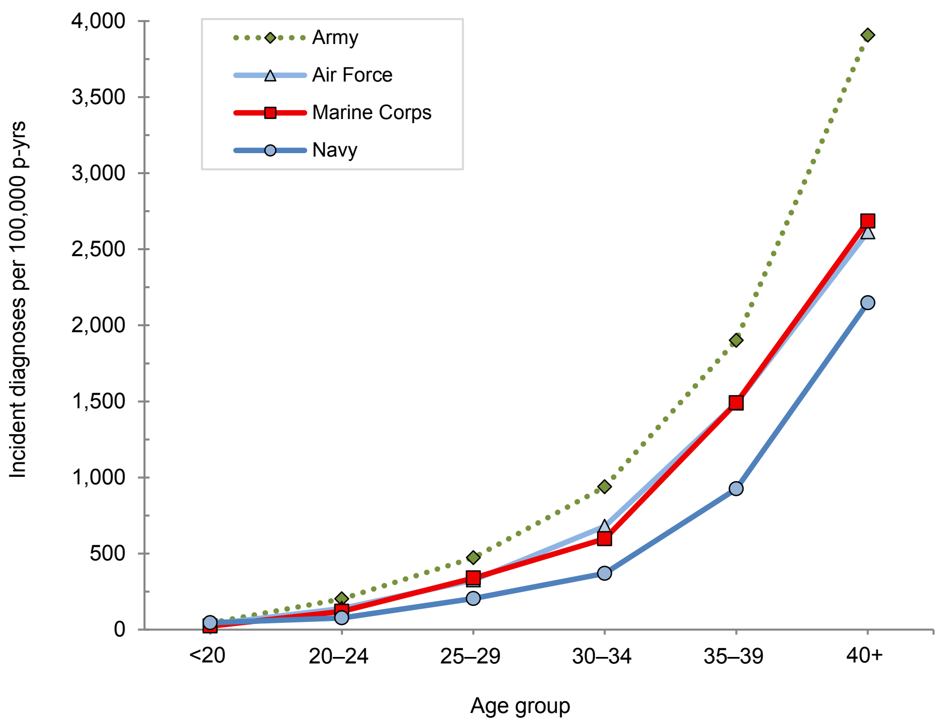



**FIGURE 2.** Incidence rates of osteoarthritis by service and age group, active component, U.S. Armed Forces, 2010–2015




anatomical sites were broadly similar among male and females. However, among service members over 25 years of age, there were marked differences in incidence rates between sexes, particularly for OA of the knee, pelvic region/thigh, and shoulder. For example, among service members aged 25 years or older, rates of OA of the shoulder were markedly higher among males than females; among service members aged 35 years or older, rates of OA of the knee and pelvic region/thigh were much higher among females than males; and in those aged 40 years or older, the rate of OA of the hand was more than twice as high among females than males **(Figure 9)**. Crude rates of OA of most anatomic sites (except the shoulder and elbow) were higher among black, non-Hispanics than other race/ethnicity groups. Of particular note, the rate of OA of the knee was more than twice as high among black, non-Hispanic than white, non-Hispanic service members **(Figure 10)**.

During the surveillance period, there were more than twice the number of incident diagnoses of spondylosis of the lumbar region (rate: 466 per 100,000 p-yrs) than any other anatomical regions. Across most anatomical locations (except the cervical region), crude incidence rates of spondylosis were generally similar between the sexes; however, the rate of OA of the cervical region was more than 230% higher among females than males **(data not shown)**.

## EDITORIAL COMMENT

The results of this analysis re-emphasize the strong relationships between clinically significant OA and spondylosis and advancing age. Across the age range of U.S. military members, rates of incident diagnoses of OA and spondylosis increased markedly with advancing age. For example, incidence rates of OA and spondylosis diagnoses were 20.5 and 8.0 times higher, respectively, among service members aged 40 years or older, compared to those aged 20–24 years. This finding underscores the importance of accounting for the effects of age when assessing the effects of other potential risk factors. For example, the crude rate of incident diagnoses of OA was higher among healthcare workers (who are relatively older) than any other occupational group; however, once adjusted for age, the highest rate of incident diagnoses was observed among members of the armor/motor transport occupational group (e.g., tank crews, truck drivers). Moreover, the dramatically higher rates of OA and

**FIGURE 3.** Incidence rates of spondylosis by service and age, active component, U.S. Armed Forces, 2010–2015

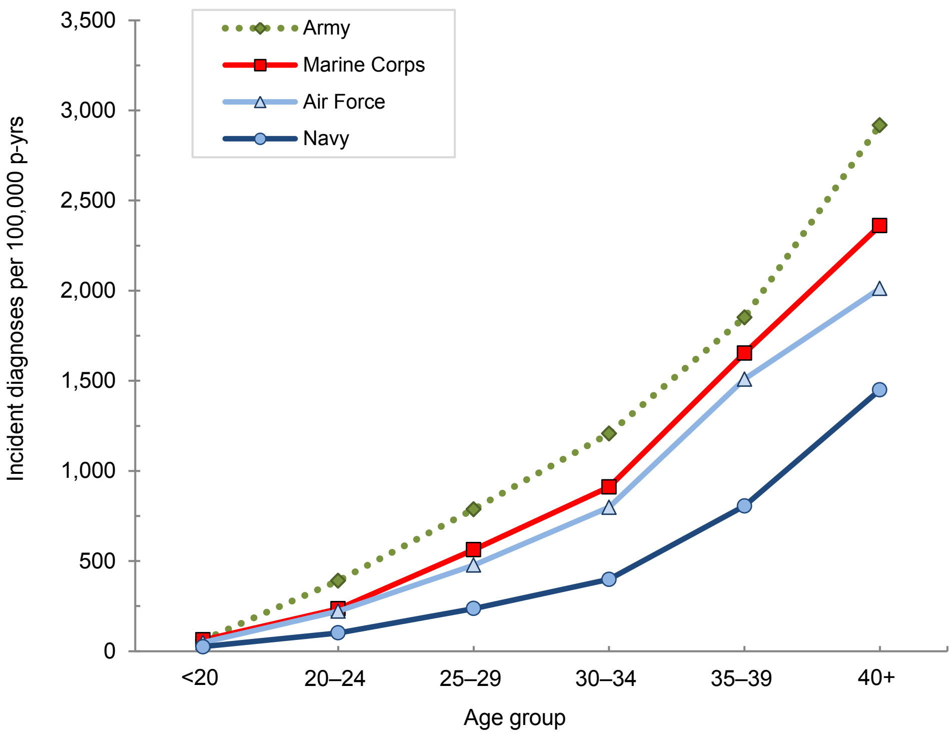
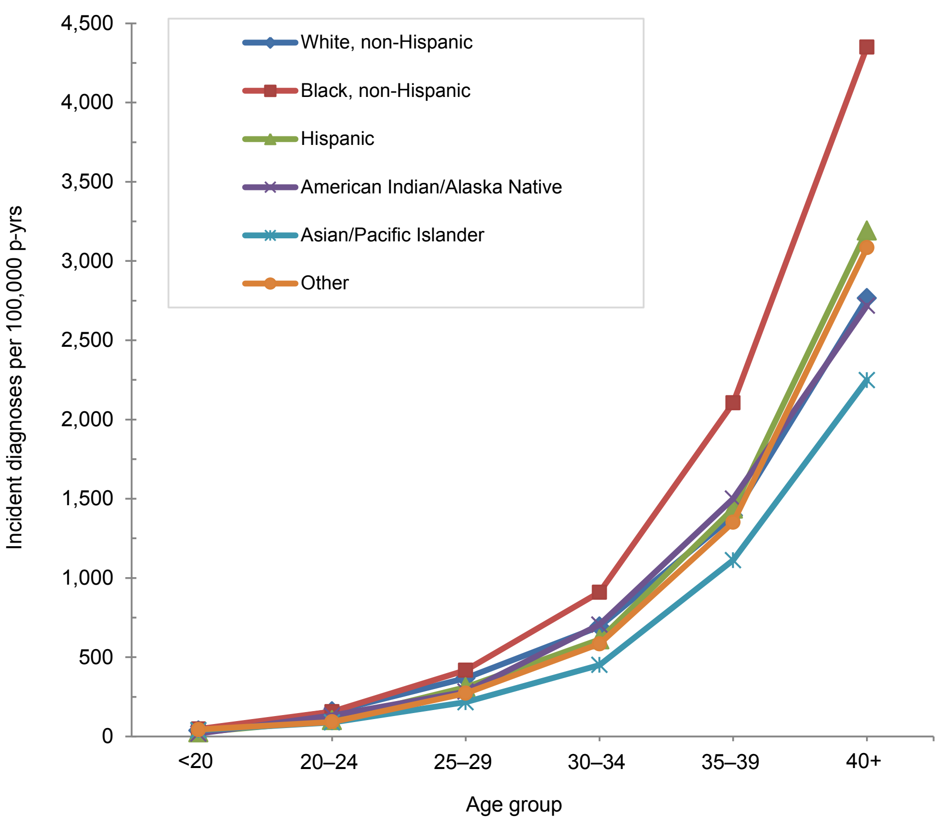



**FIGURE 4.** Incidence rates of osteoarthritis by race/ethnicity and age group, active component, U.S. Armed Forces, 2010–2015




spondylosis among senior enlisted and officer personnel (who are older than their junior counterparts) are entirely consistent with the age-related incidence of OA and spondylosis. After adjusting for age, compared to their respective counterparts, rates of OA diagnoses were higher among black non-Hispanic service members and Army members, while rates of spondylosis diagnoses were higher among females; white, non-Hispanic service members; and Army members.

In all demographic subgroups, the lower leg (knee joint) was the anatomic site most frequently affected by OA. Age-specific OA incidence curves were broadly similar for both sexes across all anatomical sites in age groups younger than 25 years. Differences in the age-incidence curves for males and females aged 30 years or older were most apparent for OA of the knee, shoulder, and pelvic region/thigh. In these age groups, female service members had noticeably higher incidence rates of OA of the knee and pelvic region/thigh than male service members and males had markedly higher rates of OA of the shoulder than females. Differences between male and female service members in incidence rates and sites of OA likely reflect anatomic, occupational, and/or physical activity-related risk factors as well as variation in healthcare-seeking behavior and/or access to healthcare at military medical facilities.

In this analysis, pilots and other aircrew members had lower crude and age-adjusted rates of incident diagnoses of both OA and spondylosis than other occupational group members. These findings, especially in regard to spondylosis, were contrary to expectations. For example, there is evidence that certain occupational conditions (e.g., helmets and headgear, awkward postures during flight, flight accelerations, whole body vibrations) associated with flying may increase risk of degenerative changes in the cervical and lumbar spines of pilots.[26-28] However, other studies have found no relationships between musculoskeletal disorders experienced by pilots and job-related factors, especially regarding whole body vibration.[29,30] Results of the current analysis may reflect a tendency among military aviators and crewmen to seek care only for conditions that significantly interfere with

**FIGURE 5.** Incidence rates of spondylosis by race/ethnicity and age group, active component, U.S. Armed Forces, 2010–2015

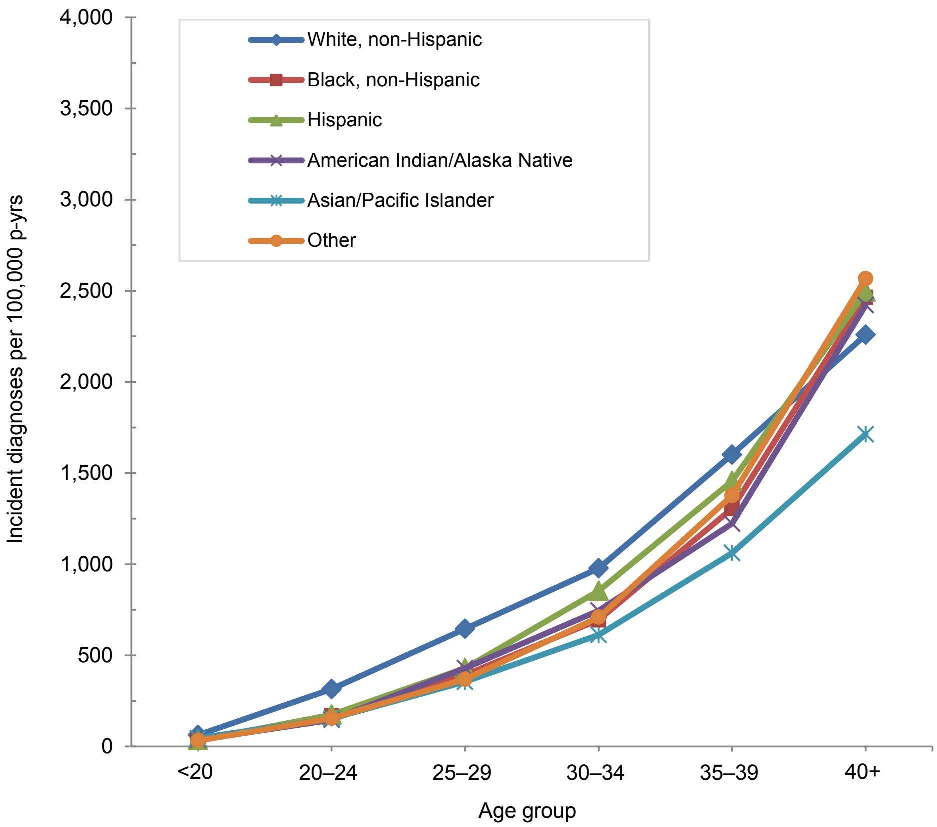
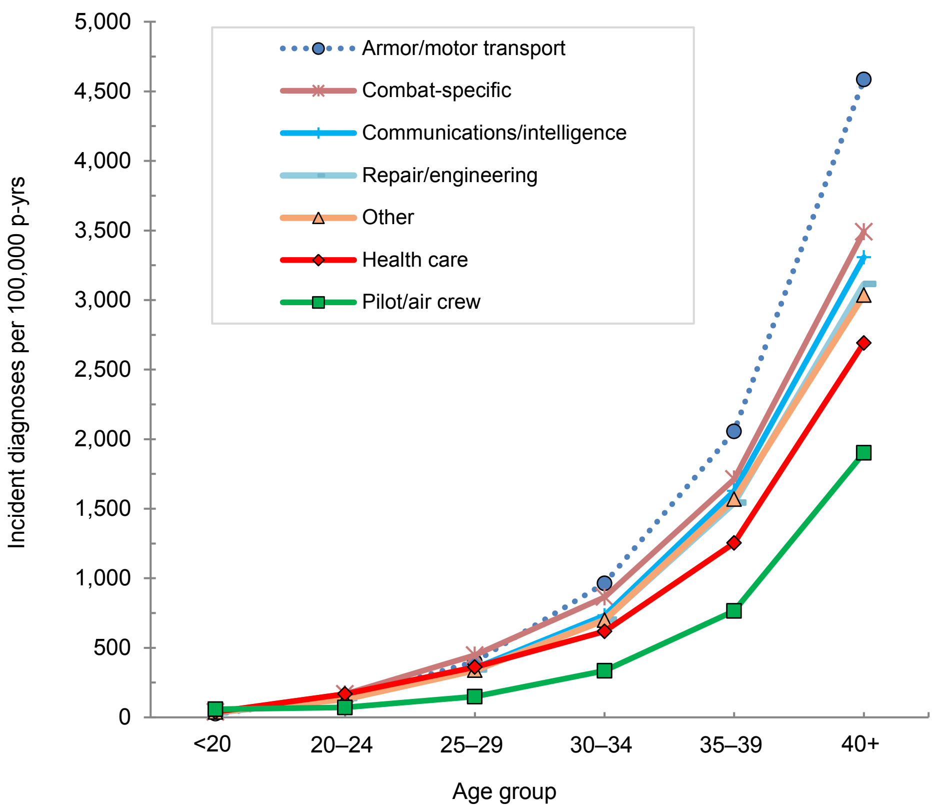



**FIGURE 6.** Incidence rates of osteoarthritis by occupation and age group, active component, U.S. Armed Forces, 2010–2015




their military occupational duties. The finding that, among service members aged 30 years or older, those in the armor/motor transport occupation category had the highest age-adjusted incidence rates of OA and spondylosis warrants additional study.

Several limitations should be considered when interpreting the results of this analysis. First, criteria for diagnosing OA and spondylosis in active service members may vary across healthcare providers and clinical settings, as well as in relation to the occupational duties of those affected. Some healthcare providers may diagnose these conditions based on symptoms alone, while others may require radiographic evidence of arthritic damage to the joints involved before reporting specific diagnoses in medical records. It is plausible that the decline in incidence of both OA and spondylosis in the last year of the surveillance period may reflect the fact that some individuals with their first outpatient visits with qualifying diagnoses of OA or spondylosis in 2015 may not have had sufficient follow-up observation periods to have had second such visits, a necessary criterion to be counted as a case.

In addition, this report summarizes diagnoses of OA and spondylosis that were reported on standardized records of hospitalizations and outpatient encounters in fixed U.S. military and civilian (i.e., purchased care) medical facilities if reimbursed through the Military Health System (MHS). Records of purchased care received at medical facilities outside of the MHS were not available for this analysis. As a result, the numbers and rates of incident diagnoses reported here likely underestimate the actual numbers and rates of incident diagnoses.

Also, there are limitations to the generalizability of the results because of the characteristics of the population. Active component service members are relatively young, healthy, physically active, and employed, and as such, may have unique risk (e.g., branch of service) and protective factors (e.g., low body mass index). Also, military members have access to health care at no personal expense; as such, conditions such as OA and spondylosis could be diagnosed and medically documented more completely and earlier in their

**FIGURE 7.** Incidence rates of spondylosis by occupation and age, active component, U.S. Armed Forces, 2010–2015

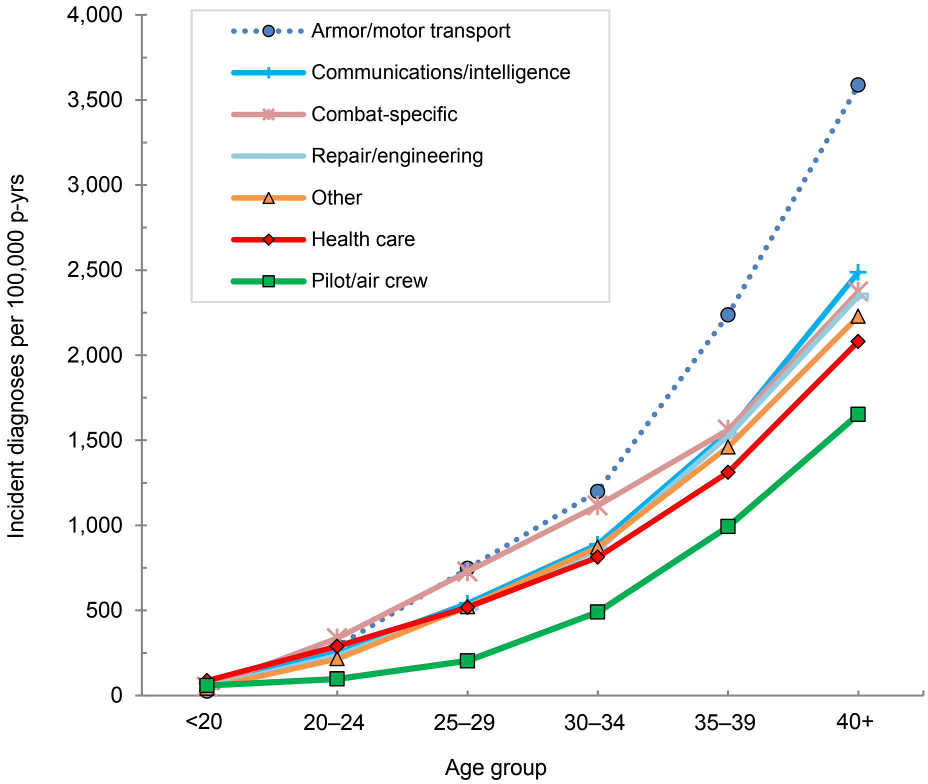
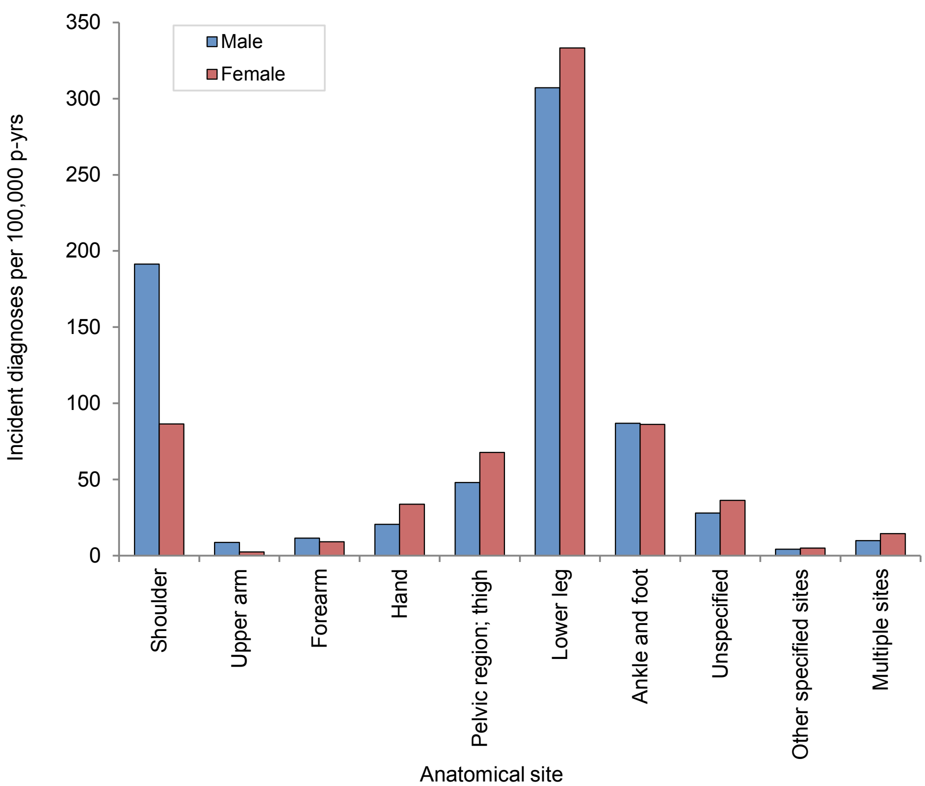



**FIGURE 8.** Incidence rates of osteoarthritis by sex and anatomic site, active component, U.S. Armed Forces, 2010–2015




clinical courses among military members than among many U.S. civilians. Thus, generalizations of the observed results should be limited to similar groups.

Furthermore, it is difficult to determine differences in rates of degenerative OA versus post-traumatic OA, especially in the active military population. In the current analysis, it is unclear how many of the incident cases of OA are the result of trauma. The physical demands (e.g., repetitive microtrauma, acute injuries) of military service potentially contribute to both conditions. Considering the high incidence and significant burden of OA among the military population, additional research is needed to clarify the role of trauma in the observed incidence of OA.

Finally, this report summarizes the numbers and rates of incident (first time per person) diagnoses of the conditions of interest. As such, the results do not necessarily indicate the prevalences or military-operational impacts of the conditions in the Armed Forces. For example, service members with disabling OA or spondylosis may leave active military service earlier than their unaffected counterparts; if so, the continuous attrition from service of those affected would lower the prevalence, military operational impacts, and health-care costs associated with the conditions among those who remain. Also, individuals who are unable to perform their occupation-specific duties due to OA or spondylosis may change occupations or separate from military service; if so, the prevalences of OA or spondylosis would be relatively higher in those occupations that retain service members with these conditions.

This report provides a descriptive summary of incidence rates of clinically relevant OA and spondylosis among active component service members. Observed differences in incidence rates of these conditions by occupational category warrant further analysis to examine adjusted (e.g., by age, sex, race/ethnicity, branch of service) incidence rates among service members within these categories. Findings also suggest a need for additional research to identify military-specific equipment and activities that significantly increase risk of acute and chronic damage to joints (particularly, the knees, shoulder, and back).

**FIGURE 9.** Incidence rates of osteoarthritis by sex, anatomical site, and age group, active component, U.S. Armed Forces, 2010–2015

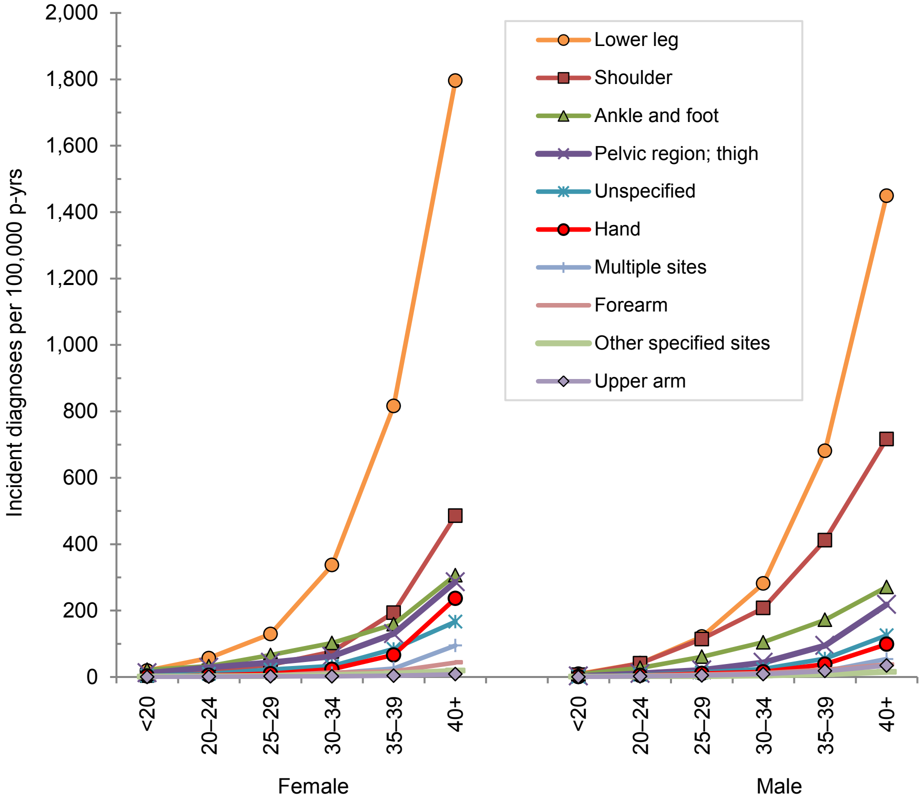
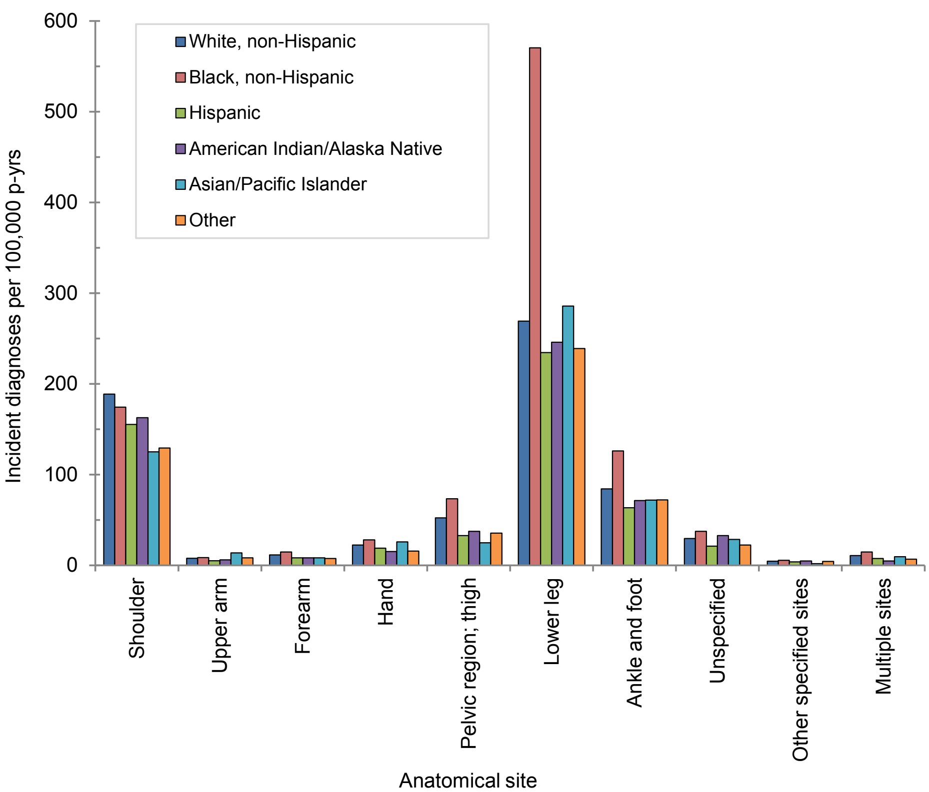



**FIGURE 10.** Incidence rates of osteoarthritis by race/ethnicity and anatomical site, active component, U.S. Armed Forces, 2010–2015




Results of such research would be useful to develop, test, and implement practical and effective countermeasures against OA and spondylosis among military members in general and those in high-risk occupations specifically.

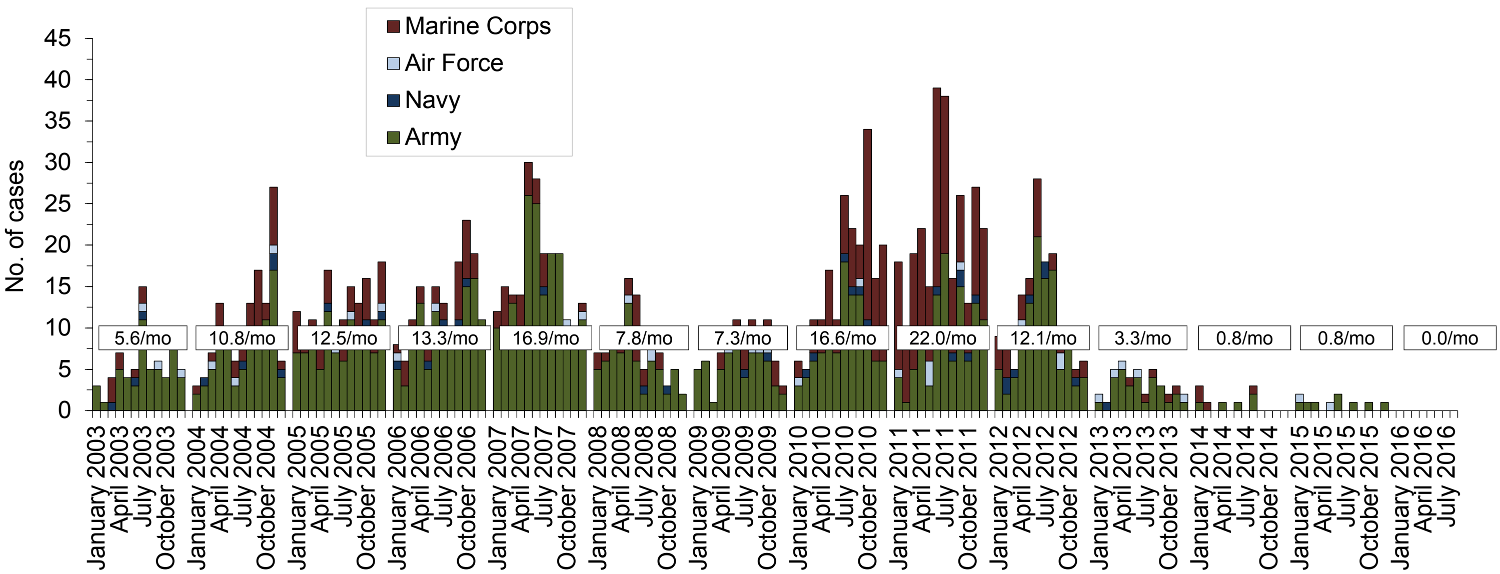
## REFERENCES


1. Kraus VB, Blanco FJ, Englund M, Karsdal MA, Lohmander LS. Call for standardized definitions of osteoarthritis and risk stratification for clinical trials and clinical use. *Osteoarthritis Cartilage*. 2015;23(8):1233–1241.
2. Cooper C, Inskip H, Croft P, et al. Individual risk factors for hip osteoarthritis: Obesity, hip injury and physical activity. *Am J Epidemiol*. 1998;147(6):516–522.
3. Spector TD, MacGregor AJ. Risk factors for osteoarthritis: genetics. *Osteoarthritis Cartilage*. 2004;12(S1):39–44.
4. Cooper C, Campbell L, Byng P, et al. Occupational activity and the risk of hip osteoarthritis. *Ann Rheum Dis.* 1996;55(9):680–682.
5. Schouten JS, de Bie RA, Swaen G. An update on the relationship between occupational factors and osteoarthritis of the hip and knee. *Curr Opin Rheumatol.* 2002;14(2):89–92.
6. Buckwalter JA, Lane NE. Athletics and osteoarthritis. *Am J Sports Med.* 1997;25(6):873–881.
7. Lohmander LS, Englund PM, Dahl LL, Roos EM. The long-term consequence of anterior cruciate ligament and meniscus injuries: osteoarthritis. *Am J Sports Med*. 2007;35(10):1756–1769.
8. Englund M, Lohmander LS. Risk factors for symptomatic knee osteoarthritis fifteen to twenty-two years after meniscectomy. *Arthritis Rheum.* 2004;50(9):2811–2819.
9. Litwic A, Edwards MH, Dennison EM, Cooper C. Epidemiology and burden of osteoarthritis. *Br Med Bull.* 2013;105:185–199.
10. Lawrence RC, Felson DT, Helmick CG, et al. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States. Part II. *Arthritis Rheum.* 2008;58(1):26e35.
11. Felson DT, Zhang Y. An update on the epidemiology of knee and hip osteoarthritis with a view to prevention. *Arthritis Rheum.* 1998;41(8):1343e55.
12. Hubertsson J, Petersson IF, Thorstensson CA, Englund M. Risk of sick leave and disability pension in working-age women and men with knee osteoarthritis. *Ann Rheum Dis.* 2013;72(3):401e5.
13. Centers for Disease Control and Prevention. Prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation United States, 2010–2012. *MMWR Morb Mortal Wkly Rep.* 2013;62(44):869.
14. Showery JE, Kusnezov NA, Dunn JC, Bader JO, Belmont PJ Jr, Waterman BR. The rising incidence of degenerative and posttraumatic osteoarthritis of the knee in the United States military. *J Arthroplasty*. 2016 Mar 21.
15. Rivera JC, Wenke JC, Buckwalter JA, Ficke JR, Johnson AE. Posttraumatic osteoarthritis

caused by battlefield injuries: the primary source of disability in warriors. *J Am Acad Orthop Surg*. 2012;20(Suppl 1):S64–S69.
16. Cross JD, Ficke JR, Hsu JR, et al. Battlefield orthopaedic injuries cause the majority of long-term disabilities. *J Am Acad Orthop Surg*. 2011;19(Suppl 1):S1.
17. Petilon J, Roth J, Hardenbrook M. Results of lumbar total disc arthroplasty in military personnel. *J Spinal Disord Tech*. 2011;24(5):297–301.
18. Cameron KL, Hsiao MS, Owens BD, Burks R, Svoboda SJ. Incidence of physician-diagnosed osteoarthritis among active duty United States military service members. *Arthritis Rheum*. 2011;63(10):2974–2982.
19. Dominick KL, Golightly YM, Jackson GL. Arthritis prevalence and symptoms among US non-veterans, veterans, and veterans receiving Department of Veterans Affairs healthcare. *J Rheumatol*. 2006;33(2):348–354.
20. Rossignol M, Leclerc A, Hilliquin P, et al. Primary osteoarthritis and occupations: a national cross sectional survey of 10,412 symptomatic patients. *Occup Environ Med*. 2003;60(11):882–886.
21. Feuerstein M, Berkowitz SM, Peck CA. Musculoskeletal-related disability in US Army personnel: prevalence, gender and military occupational specialties. *J Occup Environ Med*. 1997;39(1):68–78.
22. Scher DL, Belmont PJ Jr, Mountcastle S, Owens BD. The incidence of primary hip osteoarthritis in active duty US military service members. *Arthritis Rheum*. 2009;61(4):468–475.
23. Kopec JA, Rahman MM, Berthelot JM, et al. Descriptive epidemiology of osteoarthritis in British Columbia, Canada. *J Rheumatol*. 2007;34(2):386–393.
24. Felson DT, Zhang Y, Hannan MT, et al. The incidence and natural history of knee osteoarthritis in the elderly: the Framingham Osteoarthritis Study. *Arthritis Rheum* 1995;38(10):1500–1505.
25. Armed Forces Health Surveillance Center. Osteoarthritis and spondylosis, active component, U.S. Armed Forces, 2000–2009. *MSMR*. 2010;17(12):6–11.
26. Petren-Mallmin M, Linder J. Cervical spine degeneration in fighter pilots and controls: a 5-yr follow-up study. *Aviat Space Environ Med*. 2001;72(5):443–446.
27. Aydog ST, Turbedar E, Demirel AH. Cervical and lumbar spinal changes diagnosed in four-view radiographs of 732 military pilots. *Aviat Space Environ Med*. 2004;75(2):154–157.
28. Byeon JH, Kim JW, Jeong HJ, et al. Degenerative changes of spine in helicopter pilots. *Ann Rehabil Med*. 2013;37(5):706–712.
29. Funakoshi M, Taoda K, Tsujimura H, Nishiyama K. Measurement of whole-body vibration in taxi drivers. *J Occup Health*. 2004;46(2):119–124.
30. Matsumoto Y, Griffin MJ. Non-linear characteristics in the dynamic responses of seated subjects exposed to vertical whole-body vibration. *J Biomech Eng*. 2002;124(5):527–532.

# Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–August 2016 (data as of 23 September 2016)

Amputations[a,b]

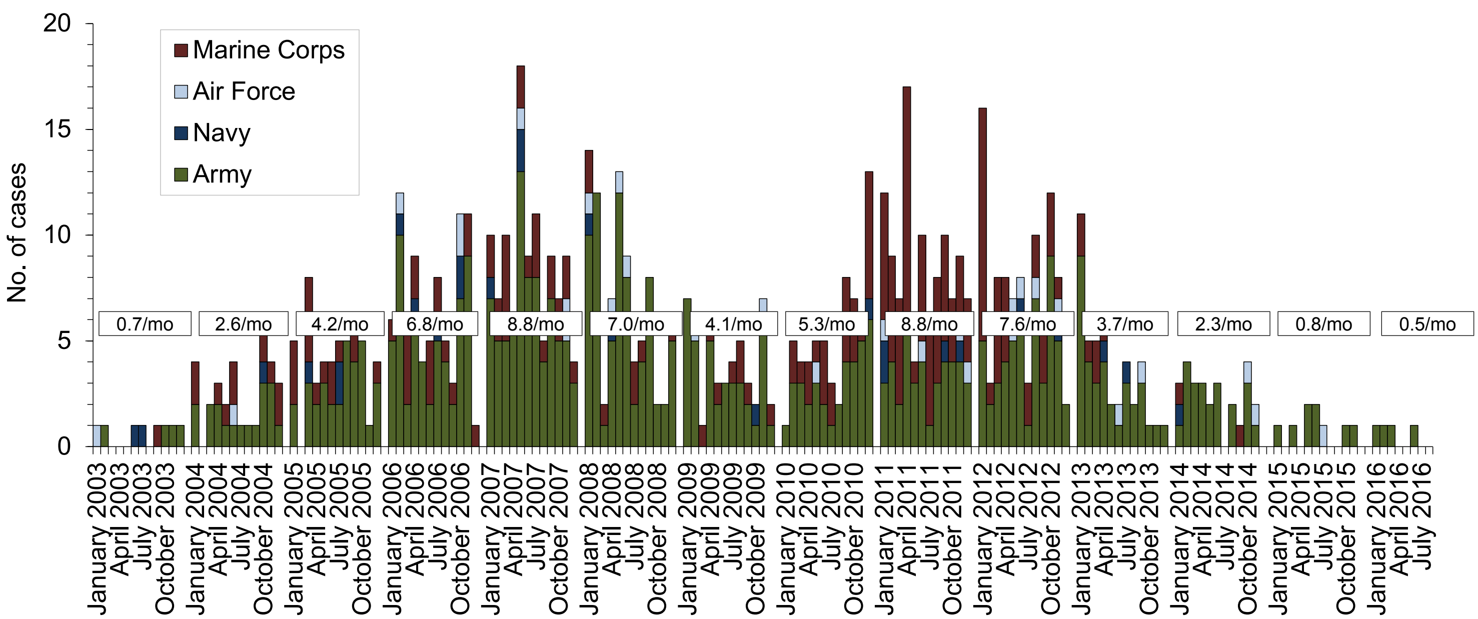



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: amputations. Amputations of lower and upper extremities, U.S. Armed Forces, 1990–2004. *MSMR*. 2005;11(1):2–6.

[a]Amputations (ICD-10: S48, S58, S684, S687, S78, S88, S980, S983, S989, Z440, Z441, Z4781, Z891, Z892, Z8943, Z8944, Z895, Z896, Z899)

[b]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from deployment.

Heterotopic ossification[a,b]




Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002–2007. *MSMR*. 2007;14(5):7–9.

[a]Heterotopic ossification (ICD-10: M610, M614, M615)

[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 365 days of returning from deployment.

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